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UNIVERSITY OF ALBERTA

INVESTIGATION OF ANOMALIES
IN ECONOMIC WELFARE ESTIMATION

by

BRUCE MACNAB

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND
RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

IN

FOREST ECONOMICS

DEPARTMENT OF RURAL ECONOMY

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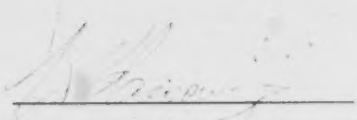
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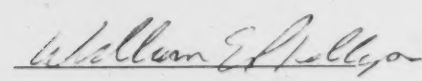
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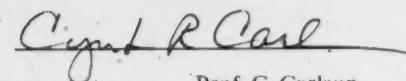
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The undersigned certify that they have read, and recommend to the Faculty of
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ESTIMATION

Submitted by Bruce J. Macnab
In partial fulfillment of the requirements for the
Degree of MASTER OF SCIENCE
in FOREST ECONOMICS


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Abstract

The objective of this study is to examine the reasons for the finding of large differences between two economic welfare measures in empirical valuations of public goods. "Willingness-to-pay" (WTP) and "willingness-to-accept" (WTA) measures of welfare change typically differ substantially when elicited from "contingent valuation method" (CVM) surveys; contrary to the expectations of standard economic theory (which suggests that they are very close in magnitude).

Several possible explanations for this anomaly are reviewed. One promising explanation, that the availability of substitutes affects the difference between the two measures, is the focus of the study. As such, a CVM survey is designed to investigate this substitute hypothesis.

A survey valuing movie tickets is administered to classes of university students. Quantitative analysis finds the means for each of the two measures to be significantly different. An attempt is then made to determine whether the difference between WTP and WTA is affected by substitute possibilities. A wide range of regressions are then estimated, using several variables, such as ownership of a videocassette recorder as proxies for substitute availability. Analysis of the movie ticket survey results generally shows no evidence of the availability of substitutes affecting WTP-WTA differences.

A CVM survey on hunting values is analyzed in the same fashion as the movie ticket survey. Analysis again shows WTP and WTA mean values to be significantly different, and regression estimates with little evidence in support of the substitute hypothesis. In general, the results of the hunting survey conforms to those of the movie ticket survey.

It is concluded that there is little, if any, evidence of the availability of substitutes affecting WTP-WTA differences.

Further research is still required into WTP-WTA differences. Large differences persist in various types of CVM applications. It remains to be determined whether these differences are a function of the valuation procedure, of the nature of the goods being valued, or of the different property rights implied by the two measures.

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Chapter 1 Introduction

In attempting to assess the economic desirability of a given project, such as the construction of a dam, economists are faced with the task of trying to estimate all relevant benefits and costs. One criteria for development suggests that if the total of all benefits exceeds the total of all costs, the project would be deemed economically desirable (with respect to efficiency at least). As is usually the case with such simplistic explanations, however, actually conducting the procedure above is "much easier said than done". In particular, quantifying benefits and costs which are not normally bought and sold on the marketplace complicates the process considerably.

While many of the potential benefits and costs of proposed projects may be relatively easy to quantify, others may be less directly measurable. We may know that the construction of a dam will cost "X dollars" and that the electricity it will generate will result in benefits of "Y dollars" annually. Electricity and construction services are bought and sold frequently on well established markets. On the other hand, many other types of potential benefits and costs are not dealt with as easily. Consider the benefits or costs associated with changes in scenic characteristics, or changes to a recreational fishing experience. Values such as these, while they may be of considerable societal importance, often do not have prices representative of their true social value.

1.1 The Nature of Public Goods

Those values which aren't generally accounted for by the market system are often termed extramarket benefits or costs. Extramarket values are the result of a failure in the market for the good in question, of one sort or another. A common cause for market failure would be undefined property rights with respect to utilization of resources. In other words, strict ownership would not be present for the good being used. Undefined property rights are a result of some of the characteristics of these types of goods (i.e. the mobility of water resources). Those goods which cannot be strictly owned (i.e. one party cannot strictly preclude use of the resource from other parties), are known as "public goods", public here implying collective (societal) ownership (i.e. as a result of undefined property rights).

Many types of goods associated with the environment (i.e. clean air or water), as well as outdoor recreation fall into the category of public goods. Other examples would include national defense and broadcast frequencies. In general, public goods either are not priced (i.e. clean air) or have only token prices attached to them (i.e. entrance to a national park).

When considering the benefits or costs associated with a project, public goods create a problem. If we are to truly account for these sorts of goods, we need an estimate of its value. With public goods lacking representative prices, getting an estimate of value becomes a difficult task. With "conventional" market goods, we get a measure of value from consumer surplus (the area under a demand curve and above price) and from producer surplus (area above a supply curve and below price). Since with public goods we do not know true prices let alone demand or supply relationships, we also will not be able to directly compute their values (i.e. consumer or producer surplus).

1.2 The Contingent Valuation Method

In attempting to account for those goods and services which do not have 'representative' prices, economists have developed several valuation techniques. One of these techniques, the 'Contingent Valuation Method' (CVM), directly asks people their valuations of specific extramarket benefits.

The CVM extracts people's valuations for public goods by using carefully constructed survey questions. Generally, a respondent is asked what they would be willing to pay (WTP) for specified units (quantity or quality) of a public good. The individual's valuation, is thus 'contingent' on there being a market for the public good in question. A CVM application then, will need to create a hypothetical market for the public good being considered.

A CVM question can take either of two forms. An individual could be asked what would be the maximum they would be willing to pay for an additional unit of a public good. Alternatively they could be asked what would be the minimum amount they would be willing to accept in compensation (WTA) for giving up a unit of that same public good. Which form the CVM question takes necessarily depends upon the property rights with respect to the good in question. More specifically, choice between the WTP or WTA measure would depend upon whether the individual had the 'right' to sell the good (i.e. WTA), or whether in order to enjoy the good, had to purchase it (i.e. WTP). The

question of who holds the property rights to the public good being considered is often a very difficult one. This especially holds true in light of the fact that with public goods, the property rights are held collectively.

The preceding discussion then leads us to questions concerning the relationship between the WTP and WTA measures. Are WTP and WTA equal or at least approximately equal? Which one should be used in which cases? And finally, could one measure be substituted for the other without sacrificing accuracy too much?

1.3 The Relationship Between WTP and WTA

Standard economic theory suggests that in most applications, values for WTP and WTA should be almost equal, differing only by a small income effect. This conclusion follows from theoretical work involving these two measures, examining both price changes (Willig 1976), and general quantity changes (Randall and Stoll 1980). In this light, it would appear that in most applications, the WTP and WTA measures would be expected to be approximately equal and virtually interchangeable.

There has also been some theoretical work which suggests that in some cases, WTA and WTP could diverge substantially. Hanemann (1986) suggests that the availability of substitutes could affect whether the two measures are quite close in value or not.

Additional theoretical suggestions on the relationship between WTP and WTA have come from areas in psychology involving behaviour in response to choices. "Prospect theory" (Kahnemann and Tversky 1979) suggests that people value equivalent losses and gains differently. More specifically, that people value what they already possess higher than they value that which they don't possess. Another suggestion involves the psychological theory of "cognitive dissonance". This theory deals with an individual's persistence of holding two contradictory positions. This could then lead to people holding two contradictory valuations for essentially the same good (i.e. significantly different values for WTP and WTA).

Most empirical work involving the CVM has been at odds with theoretical expectations. In most applications, WTA values have been much larger than corresponding WTP values (Bishop and Heberlein 1979, Brookshire et Al. 1980, Rowe et Al. 1980, Knetsch and Sinden 1984). WTA values of three to five times WTP values have been typically found in empirical work eliciting both measures (Cummings et Al. 1986).

We are then led to consider what is the true relationship between WTA and WTP. In addressing this issue, there are three basic lines of thought. First, that the WTP/WTA divergence is a fabrication of weaknesses contained in the elicitation procedures used in CVM applications. More specifically, that the divergences are mainly a result of measurement errors inherent to hypothetical survey techniques. Second, that the divergence is a result of difficulties within one of the measures. Third, that the divergence is a result of previously overlooked components which in some cases, would make WTP and WTA inherently different (i.e. substitute relationships).

The purpose of this study is to investigate possible causes for the frequent empirical finding of large WTP/WTA divergences in CVM applications. In particular, to add further research towards representing the empirical results typically found within an economic framework. Suggestions have come from both economics and psychology, it is important that the apparent anomaly be settled in regards to economic theory (so to be able to deal with economic problems).

In a CVM application, the two measures could result in vastly different estimates of the benefits or costs associated with a given project. As a result, each measure could give different responses in regards to a project's efficiency in a benefit-cost analysis. It then follows that research into what might be the true economic relationship between these two measures would be important in benefit-cost applications.

Chapter 2 Theoretical Background

The need to compare between the existing state and a potential future one is a frequent task of economists. It is quite common to wonder how a future state, as a result of some proposed project, will affect the overall well-being of certain groups of individuals, or perhaps more importantly, of society as a whole. "Welfare Economics" is the branch of the economics profession which attempts to address these types of problems.

Because this study deals with an issue regarding the valuation of benefits and costs within a welfare economic context, it will first be necessary to give a theoretical overview of some relevant welfare economics concepts. In short, to introduce those welfare concepts which are fundamental to the understanding of the problem at hand in this study. Following this relatively general discussion, the next section of the chapter will outline the relationship between willingness-to-pay and willingness-to-accept (again denoted as WTP and WTA), both from the standpoint of standard economic theory and from empirical estimates using the contingent valuation method (again denoted as CVM). The next section will present proposed explanations for the apparent anomaly between standard economic theory and empirical findings. Here alternative theories will be presented which attempt to resolve the apparent impasse. Finally, the course of this research task will be outlined.

2.1 Welfare economics concepts

2.1.1 Pareto Criterion

The economic evaluation of changes in welfare has a rather long history. One of the earliest and most widely discussed concepts in the evaluation of welfare is the Pareto criterion. The Pareto criterion was introduced by Vilfredo Pareto (1896) as a means of determining the social desirability of policy changes. A policy change would be socially desirable by the Pareto criterion, if, following the change, some people are made better off while no one is made worse off. While this criterion is a useful starting point in welfare analysis, its range of applicability is very limited. This criterion is unable to compare many policy changes (Just et Al. 1982). As an example, while the Pareto criterion can compare between an inefficient state (Pareto inferior) and an efficient state (Pareto superior), it is unable to compare two Pareto efficient states. This is indeed a problem, as most policy changes probably involve situations where there are both gainers and losers (Thurow 1980).

2.1.2 Compensation Principle

Another means of evaluating welfare changes which has received considerable discussion is the "compensation principle" (Hicks 1939, Kaldor 1939). The compensation principle was developed largely in response to weaknesses in the Pareto criterion. The compensation principle examines, when moving from one state to another, whether the gainers could potentially compensate the losers such that everyone would be better off following the change. As with the Pareto criterion, however, the compensation principle is limited in its applicability (see Arrow 1951, Samuelson 1950, Scitovsky 1941). As an example, the compensation principle can not always be used to compare between pairs of second-best (Pareto inefficient) states (Scitovsky 1941). Scitovsky illustrated that when evaluating certain welfare changes, it may not be enough to determine whether the gainers could potentially compensate the losers. When comparing certain pairs of second-best states, the Scitovsky reversal paradox might occur if the corresponding indifference curves cross. As a result, it also must be determined whether the losers could bribe the gainers not to make the change (the reversal paradox). A welfare change where the reversal paradox occurs, therefore, cannot be evaluated using the compensation principle. Consequently, while the compensation principle's range of applicability exceeds that of the Pareto criterion, it still is unable to deal with certain policy questions.

2.1.3 Benefit-cost analysis and measures of welfare

Another criteria which is used to evaluate welfare changes involves trying to quantify respective benefits and costs associated with the change. Benefit-cost analysis specifies that a change is economically efficient if the total of all benefits exceeds the total of all costs. This may be relatively straightforward in the case of production activities. Producer welfare measures can in many cases be determined directly. Conversely, in the case of consumers, no measure of welfare is directly observable. This follows from utility being an ordinal rather than a numerical concept (Just et Al. 1982).

In trying to address benefits and costs associated with consumers, it is necessary to develop money measures of welfare change (Boadway and Bruce 1984). The notion of consumer surplus is an attempt to get such a money measure of welfare change. A caveat may be required here to note that consumer surplus measures are not cardinal measures of utility change. Instead, they are money measures of welfare change—an attempt to measure utility indirectly through imposing a cardinal

component to preference orderings (Boadway and Bruce 1984). Consumer surplus can be broadly defined in a graphical sense as the area under a demand curve and above the price line. In this way, it is what a consumer would be willing to pay over and above the current price for each successive unit of a given good.

The concept of consumer surplus, unfortunately, is not a unique measure. There are in fact several consumer surplus measures.

2.1.4 Measures of consumer surplus

The traditional measure of consumer surplus is known as Marshallian consumer surplus. It is the area under an ordinary (Marshallian) demand curve and above the price line (Mitchell and Carson 1989). The concept of Marshallian surplus has the drawback of being derived from a Marshallian demand curve which holds income rather than utility constant. As a result, it isn't a true measure of welfare, but rather an estimate.

Hicks (1943) suggested four measures of welfare which are derived from a Hicksian demand curve (holding utility constant). Two of these measures, compensating and equivalent variations are observed to be generally applicable in the sense that they are consistent with competitive behaviour (Just et Al. 1982). Compensating variation (CV) "is the amount of income which must be taken away from a consumer (possibly negative) after a price and/or income change to restore the consumer's original welfare level" (Just et Al. 1982, p.85). Equivalent variation (EV) "is the amount of income that must be given to a consumer (again possibly negative) in lieu of price and income changes to leave the consumer as well off as with the change" (Just et Al. 1982, p.85). Thus, CV keeps the initial level of utility constant, while EV keeps the final level of utility constant.

One interpretation of EV is as the consumer's WTP to avoid an adverse welfare change, or alternatively, WTA in the case of a precluded positive welfare change (here, adverse and positive being in relation to the consumer). CV is then the consumer's WTA in order to accept a negative change, or alternatively, WTP to have a positive welfare change occur. Consider the example of a decrease in air quality as a result of the construction of a factory in a certain area. WTP to avoid having the factory built (thus, existing air quality retained) is the EV measure, and WTA to accept having the factory built (thus, the occurrence of decreased air quality) as the CV measure. In the first case, WTP is the amount of money a consumer will pay in lieu of a quality change (the decreased air

quality created by the proposed new factory) to leave the consumer as well off as if the change had occurred (i.e. final utility - EV). In the second case, WTA is the amount of money which must be given to the consumer after a quality change to leave the consumer as well off as if the change had not occurred (i.e. initial utility - CV). We could also have the case of a positive welfare change to consumers, say legislation requiring existing factories to apply a technology which would increase air quality. Here, WTP to have the change occur is the CV measure, while WTA to have the change occur is the EV measure.

When considering a given policy change then, any one consumer could have two different welfare measures. In general terms, they could have both, WTP for something positive (i.e. a precluded negative change or the occurrence of a positive change), and WTA for something negative (i.e. a precluded positive change or the occurrence of a negative change). Thus, a CVM evaluation of a policy change's effects on a particular group of people could potentially be voiced either in the WTP form or the WTA form. When conducting a benefit cost analysis, either of these two measures could be theoretically used. Therefore we must consider the relationship between these two estimates of consumer surplus. More specifically, the following issues need investigation: whether the two measures are approximately equal in magnitude, whether one should be used over the other in some cases, and whether they can be substituted for each other on some applications.

2.2 The relationship between WTP and WTA

2.2.1 Standard Economic theory

Before proceeding to examine the relationship between WTP and WTA predicted by standard economic theory, it will first be necessary to note the following simplification. When considering the difference between WTP and WTA, WTP will represent the EV necessary to avoid a policy change, while WTA will represent the CV to accept the occurrence of this same change. It is in this context that the two measures have been compared.

Utility theory has assumed that an individual's valuation of equivalent losses (i.e. WTA) and gains (i.e. WTP) should be equal. This position was for the most part supported by theoretical work involving these welfare measures done by Willig (1976). Willig argued that for price changes, the EV (WTP) and CV (WTA) measures should be, in practice, very close in value. The two measures would differ in that WTA would involve an additional income effect not present in the WTP measure. In

most applications, however, this income effect is assumed to be very small (Freeman 1979, Knetsch and Sinden 1984). For price changes, Willig found that the Marshallian measure, which lay between CV (WTA) and EV (WTP), was within two percent of either of the two measures (implying approximately a four percent difference between WTP and WTA) for most cases.

Further theoretical work extended Willig's near equivalence to general quantity changes. Randall and Stoll (1980) found that for general quantity changes, measures of WTP and WTA should be within five percent of each other. Randall and Stoll found that the measures should be quite close in most cases of quantity changes, however, this finding did not carry over to some cases of discrete quantity changes. Thus, it would appear that near equivalence of the two measures is justified for price changes and in many cases of quantity changes.

2.2.2 Empirical results using the CVM

The near equivalence predicted by standard economic theory has been contrary to the results of most empirical work trying to elicit WTP and WTA through the CVM. Hammack and Brown's (1974) study of waterfowl benefits found WTA to be over four times WTP. Bishop and Heberlein (1979) received WTA values of five times WTP. Similar results have been found in subsequent studies (see Brookshire et Al. 1980, Rowe et Al. 1980, Knetsch and Sinden 1984). In general, "derived measures of WTA are consistently larger-on the order of three to five times larger-than measures of WTP" (Cummings et Al. 1986, p.35). We then get the outline of the inconsistency between the theoretical expectations of utility theory, and the derived results using the CVM.

2.3 Possible explanations

The possible explanations for the anomaly between standard economic theory and empirical results using the CVM can be categorized into three groups. The first group includes explanations supporting standard theory, and claiming that the difference is a function of the empirical procedures involved in eliciting WTP and WTA. The second group includes explanations from psychology research involving individual choice behaviour. The third group includes alternatives from within economics which might account for an inherent difference between WTP and WTA.

2.3.1 Explanations related to standard economic theory

Explanations for the empirically observed large difference between WTP and WTA have, from the start, been those which tended to support standard economic theory. In this category are explanations of the WTP-WTA difference relating to problems with the CVM in a general sense, as well as those relating to either of the measures.

2.3.1.1 Problems with the CVM

Explaining the WTP-WTA difference by appealing to problems with the CVM in general has tended to report that the differences were a result of weaknesses in data collection, interviewing technique, or questionnaire design (Brookshire et Al. 1980, Dwyer and Bowes 1978). Inconsistencies in two supposedly near equal measures would thus lend support to attributing the WTP-WTA difference to something in the nature of the CVM itself. In particular, that respondents of CVM surveys may not have enough incentive to give truthful answers. This sort of view would be attractive to those who feel that hypothetical survey techniques are without much in the way of merit, and that only actually observed market data are useful in economic analysis (see Feenberg and Mills 1980).

"Biases" in the CVM because of its hypothetical nature are frequently used as explanations of the large WTP-WTA differences. Strategic, information, vehicle, and starting point bias are often included in the list of biases (Schulze et Al. 1981). I will note here that a more detailed description of issues related to types of "bias" in the CVM will be presented in the next chapter. While biases within the CVM may account for at least some of this apparent inconsistency, empirical work has not always confirmed this hypothesis. Evidence on strategic bias has tended to show it to be of little importance in those studies testing for it (Rowe et Al. 1980, Brookshire et Al. 1980). In addition, the evidence for the other forms of possible bias has been inconclusive (see Schulze et Al. 1981, Thayer 1981 for detailed discussions of bias in the CVM). While biases may often account for some of the traditionally observed WTP-WTA difference, it would seem necessary to seek other explanations for the commonly found three to four-fold differences.

2.3.1.2 Problems with the WTA measure

Another group of explanations which tends to support the expectations of standard economic theory includes views that one of the two measures is, in general terms, problematic. Many researchers feel that WTP should be used but not WTA (this seems to be the general conclusion in

part I of Cummings et Al. 1986). This position originates primarily from the tendency of WTP to perform better than WTA in comparison studies. WTP values tend to correspond more closely than WTA values to estimates from other methods of nonmarket valuation (i.e. hedonic methods, travel cost), or to simulated market data (see Cummings et Al. 1986). Any conclusion, however, that WTA should be dropped from application solely for this reason does not automatically follow. Any rejection of the WTA measure requires some sort of theoretical justification. In this regard we have two possibilities. The first being that consumers make cautious valuations. The second suggests that many respondents reject the property right implied by WTA-type questions (i.e. they find the property right to be either perverse or implausible).

The cautious consumer hypothesis

Hoehn and Randall (1987) assert that consumers make cautious valuations of goods when they are relatively unfamiliar with the good in question, when they lack the time to completely optimize their decision, and/or when they are risk averse. In CVM surveys then, it is asserted that individuals are relatively unfamiliar with the concept of having to place dollar values on goods such as environmental assets (i.e. scenic beauty). Thus, by being cautious consumers, individuals unfamiliar with the CVM format (or lacking the time to completely optimize, or who are risk averse) will tend to overstate their WTA and understate their WTP. This result would perhaps then explain why WTP and WTA values are observed to differ by such large amounts.

In empirical work (Coursey et Al. 1987), the disparity between WTP and WTA lessens with repeated trials, with most of the convergence coming from the WTA measure. This could be seen as an indication that individuals are less familiar with WTA-type questions (as their initial "uninformed" values are much more different from their final "informed" values) than they are with WTP-type questions. As a result, proponents of this line of thought feel that answers given to WTA-type questions will be less accurate than will be answers to WTP-type questions.

The cautious consumer hypothesis seems to offer a promising explanation for the occurrence of large WTP-WTA differences. It seems reasonable that when faced with a certain degree of uncertainty, consumers will want to play it safe. However, consumers will not necessarily be less familiar with WTA-type questions. The acceptance of employment can be seen as an act of determining the amount of compensation required for giving up certain amounts of leisure time. In

most applications in which the CVM is employed (i.e. recreation or aesthetic values), the right to the good has often been seen as a natural freedom which was neither bought nor sold on the marketplace. As such, it doesn't seem obvious that an individual will have more experience in determining their WTP than they will for their corresponding WTA.

Rejection of the WTA property right

Related to the above explanation is one which explains the WTP-WTA difference by appealing to a rejection by consumers of the property right implied by WTA questions. This assertion stems from two tendencies: the occurrence of many more refusals to answer with WTA questions than with WTP questions, and the greater percentage of WTA answers which are "outrageously" high (Mitchell and Carson 1989). Some researchers see these characteristics as signalling that many people don't accept the property right implied in WTA questioning. As a result, the WTA answers within CVM questionnaires would be seen as giving generally unreliable results, which are representing protest votes more than actual valuations.

The treatment of refusals to answer or questionable responses however, would seem to be somewhat problematic. Underlying the assertion that rejection of the WTA property right is the cause for the WTP-WTA differences, is a necessary assumption which must be made on how to treat refusals to answer, and more importantly, outrageously high answers. This assumption being, that refusals to answer and outrageously high answers are not truly a reflection of individual attitudes. Rather, they would represent a lack of understanding for the format being used, or a rejection of the WTA property right. These types of responses can then be treated as non-participants to the experiments. On the other hand, these types of responses could also be seen as refusals to sell (Bishop and Heberlein 1986). In this case the assumption would be that the responses given, especially the outrageously high WTA answers, are in fact reflecting actual attitudes (i.e. people simply do not want to sell their right at what is considered a reasonable price).

Little can be said about the usefulness of the preceding hypothesis in regards to explaining observed WTP-WTA differences. There has been little investigation of refusals to answer and high values. More research is no doubt required to see if and why the property right is being rejected.

2.3.1.3 Explanations from the Psychology-Economics literature.

A second group of explanations for the observed WTP-WTA differences comes primarily from the psychology-economics literature involving individual behaviour when making choices. The general view here being that WTP-WTA differences could be real and not simply functions of the testing regime and other related problems. This view originated from empirical work related to choice behaviour (Kahnemann and Tversky 1979, Kahnemann, Knetsch, and Thaler 1986). This category would include Prospect theory (Kahnemann and Tversky 1979).

Prospect theory

Kahnemann and Tversky's of prospect theory involves the often observed condition that individuals may have different values for losses and gains of the same magnitude. For example, given a specified change in the environmental quality of a recreation area, an individual's WTP for a increase in quality, and that same individual's WTA for a reduction in quality of the same magnitude, would be different. "This would suggest, for example, separate indifference maps to illustrate acquisition and disposal decisions" (Knetsch and Sinden 1984, p.519-520). WTP and WTA measures would be different, as they would be based on different value functions.

Prospect theory represents an interesting approach to the WTP-WTA difference. It has a certain intuitive appeal, in that it seems reasonable that people may value that which they already possess higher than they value that which they don't already possess. A certain amount of emotional attachment may have value. The consideration which is perhaps more important though, is that if losses and gains from a reference point are seen to be based on different utility functions, what then is (are) the underlying reason(s) for this property. More specifically, to answer economic problems, we should be able to explain behaviour on economic terms.

2.3.2 Alternative economic theories

There have also been alternative economic theories which have attempted to explain the observed WTP-WTA differences. These are theories based on economic principles which address a potentially real WTP-WTA difference. This work has followed empirical work suggesting that the WTP-WTA differences persist in situations involving actual market transactions (Knetsch and Sinden

1984, Gregory 1987). The principle theory here would be an assertion that the WTP-WTA difference is dependent on the availability of substitutes for the good in consideration.

2.3.2.1 The effect of substitutes on WTP-WTA differences

Hanemann (1986) in a reformulation of Randall and Stoll's (1980) theoretical work involving consumer surplus measures resulting from quantity changes, suggested that the availability of substitutes could affect the WTP-WTA difference. Hanemann argues that "for quantity changes there is no presumption that WTP and WTA must be close in value and unlike price changes, the difference between WTP and WTA depends not only on an income effect but also on a substitution effect" (Hanemann 1986, p.2). Hanemann shows that when there is a perfect substitute for the good being valued, WTP and WTA will be equal in the absence of any income effect. Conversely, when there are zero substitutes for the good, WTP and WTA can be vastly different. Thus, WTP and WTA measures depend on a parameter reflecting the degree of substitutability of the good being valued. In this way, Hanemann demonstrates that Randall and Stoll's "bounds are consistent with substantial differences between WTP and WTA" (Hanemann, p.3).

That the WTP-WTA difference could depend on the availability of substitutes has a certain intuitive appeal. If a public good has many close substitutes, it would seem likely that an individual's WTA shouldn't be substantially more than their WTP (as this individual can select from other substitute opportunities). On the other hand, when a public good has zero substitutes or extremely few substitutes (i.e. a unique wilderness area or an endangered species), "WTP could equal the individual's entire (finite) income while WTA could be infinite" (Hanemann, p.2). In addition, Hanemann's theory is attempting to deal with the observed WTP-WTA difference through a line of inquiry well rooted in economics (i.e. substitute relationships). While this doesn't give Hanemann's theory *a priori* superiority over say the psychology-economic theories, it enables us to test his theory within an economic methodology. It provides an explanation of observed behaviour via economic reasoning (so as to be able to represent this behaviour for modelling and application, etc.).

2.4 The research plan

The research presented in this paper is an attempt to test for the influence of the availability of substitute opportunities on WTP-WTA differences. More specifically, an attempt to test Hanemann's

arguments through empirical work. As such, it is not attempting to address all the proposed explanations, but one promising avenue of economic research. Directly following therefore, will be a description of an empirical study designed to address this problem.

Chapter 3 Experimental Design

The focus of this study now will pursue the methods and manner in which the experimental component will be undertaken. More precisely, the formulation and implementation of a CVM survey, designed in light of the research query at hand (whether the availability of substitutes affects the difference between WTP and WTA measures of welfare change).

The first section of this chapter will address issues regarding the construction of CVM surveys. Issues presented here include the potential biases in the CVM technique, and alternative forms that CVM questionnaires can take. Following this, specific issues in the CVM survey used in this study will be examined. As such, the second section will be a detailed analysis of the questionnaire, the choice of a good, of the functional scenario, and the major questions. The final section describes the evolution of the questionnaire; an examination of both the problems encountered with the questionnaire in pretests, and how these problems were interpreted. Finally, further discussion will illustrate how the questionnaire was changed in response to these problems.

3.1 Issues in CVM survey design

As the CVM attempts to quantify the benefits and/or costs of specified changes in welfare, the reliability of the measures it derives have been a frequent topic of discussion. Typically this discussion has involved potential sources of "bias" in CVM measures. The most commonly cited forms of potential bias - or perhaps more appropriately - potential sources of measurement error, will be described here. Under this heading, we commonly find issues regarding strategic, hypothetical, information, vehicle, and starting point measurement error or bias. Issues related to bias and the CVM could compose several treatises by themselves, therefore, discussion will be limited to a fairly superficial coverage of the primary potential causes.

3.1.1 Hypothetical issues

One of the most common criticisms directed towards CVM surveys involves its hypothetical component. As the CVM constructs a hypothetical market for some good, we might also expect a hypothetical answer in regards to a respondent's valuations. Due to the hypothetical nature of the technique, some have suggested that the results would be of little use (Feenberg and Mills 1980, Freeman 1979). This problem may be a result of subjects not having much incentive to consider what

their true valuations are in the somewhat hypothetical situation (especially when confronted with transactions in which they lack experience). In response to this potential problem, much CVM related research has gone into the validity of responses to hypothetical situations.

Although the literature contains remarks such as, "money talks and real money talks louder than hypothetical money" (Bishop et Al. 1983, p.629), current research appears to support the contention that hypothetical valuations have a fair degree of validity (Mitchell and Carson 1989). Studies involving respondent's valuations in both real and hypothetical markets have been an interesting body of evidence. While there have been experiments where real and hypothetical markets have produced contrasting results (Bishop and Heberlein 1979, Bohm 1972), much of the work along similar lines has produced relatively consistent results (Gregory 1986, Grether and Plott 1979, Knetsch and Sinden 1984, Lichtenstein and Slovic 1973).

3.1.2 Strategic issues

Another concern with respect to the validity of CVM responses involves possible strategic behaviour. The notion is that economic agents will tend to answer strategically so that their personal views will receive more weight (i.e. environmentalists overstating their WTP to preclude development in a scenic area). This is the view of Samuelson (1955) in regards to having people reveal their true preferences towards public goods. In general, however, strong evidence of strategic behaviour has not been found in CVM surveys (Cummings et Al. 1986). Most studies testing for strategic behaviour have shown it to be either nonexistent or negligible (Bohm 1972, Brookshire et Al. 1976, Mitchell and Carson 1981, Rowe et Al. 1980, Smith 1977). While "strategic behaviour should be treated as one of the many potential biases" (Mitchell and Carson 1989, p.168), "empirical evidence thus far does not support the existence of strategic bias" (Schulze et Al. 1981, p.156).

3.1.3 Information issues

There are a series of potential sources of bias or measurement error which fall into the information issue category. Cummings et Al. (1986) list three different sources of information bias. The first source would include effects frequently termed starting point and vehicle bias, each of which will be dealt with separately. The second involves the order in which information is collected or elicited from CVM respondents. The third includes the quantity and quality of information given to the subjects.

The evidence for Cummings et Al.'s second and third sources of possible information bias has been mixed. In reference to the quality and/or quantity of information, significant differences have been found in some empirical work (Rowe et Al. 1980), but not in others (Schulze et Al. 1983). In a study examining the effects of different sequences of information, Brookshire et Al. (1981) found that the order in which information is presented to subjects is significant.

3.1.4 Vehicle issues

The potential source of measurement error which is often termed vehicle bias, refers to a subject's WTP and/or WTA being affected by the way the CVM survey indicates payment will be made (Schulze et Al. 1981). For example, a subject's WTP would be different if payment was collected in the form of an entrance fee, than it would be if payment were through a form of taxation.

The fact that the payment vehicle affects a respondent's valuations has been demonstrated in some empirical work (Daubert and Young 1981, Greenlay et Al. 1981), while other work has been inconclusive (Brookshire et Al. 1980, 1981, Rowe et Al. 1980). The direction of the bias appears to depend upon the specific type of tax or fee. As an example, Daubert and Young (1981), in a study of recreation demand, found that payments, when they were to be made by increments on county sales tax, exceeded those when they were to be made as entrance fees. In general, it has been stated that there seems to be "rather persistent evidence that supports the vehicle bias proposition" (Cummings et Al. 1986, p.33).

3.1.5 Starting point issues

Possible "starting point bias" concerns CVM surveys which use bidding games to elicit WTP or WTA. It suggests that an individual's valuation will be affected by the point at which the bidding game is started (Thayer 1981). The importance of starting point bias is again inconclusive, with some finding little evidence (see Brookshire et Al. 1980, 1981, Thayer 1981), and others finding it to be significant (Rowe et Al. 1980).

As can be seen from the discussion above, the prevalence of the different types of bias in CVM surveys is, in many ways, still inconclusive.

The general heading of CVM surveys contains several alternative questioning regimes. These different regimes are a result of trying to construct CVM surveys which minimize the effects of the various potential biases (thus maximizing the accuracy of the results). A brief description of three forms of CVM valuation questions: open-ended, close-ended, and payment cards follow.

3.2 Questioning alternatives

3.2.1 Open-ended questions

The simplest and most direct approach of eliciting WTP and WTA values from survey subjects involves directly asking them for their maximum WTP, or alternatively, their minimum WTA for the good in question. This method has the advantages of being extremely direct and simple for the respondent, as well as not suffering from problems of potential starting point bias which are found in some of the other elicitation methods. Its potential weakness regards the lack of experience that subjects may have in valuing goods which they have never had to place a value on. More specifically, a one-time bid, in a transaction setting that is unfamiliar to them, may not be enough to extract accurate valuations.

3.2.2 Closed-ended questions

Closed-ended CVM questions (see Sellar et Al. 1985) involve having subjects respond to specific dollar values. Thus, subjects would be asked whether they would be willing to pay or willing to accept specific amounts. This type of questioning has the disadvantage of being prone to bias associated with the specific dollar value used in the questioning (what may be termed as starting point bias as defined earlier in this chapter).

3.2.3 Payment cards

The payment card technique (Mitchell and Carson 1981) provides a list of dollar amounts which the subject can choose from. This method was developed largely so as to avoid the potential starting point bias in closed-ended questions, by providing several alternative starting points. It may still suffer however, from forms of bias implied by the ranges of values on the payment cards (Mitchell and Carson 1989).

3.2.4 Bidding games

The bidding game format (Davis 1964) attempts to probe subjects for their maximum WTP or minimum WTA by raising (WTP) or lowering (WTA) the dollar amounts in continued questioning. This form of questioning was developed (and herein lies its primary virtue) largely for the following reason: as an attempt to arrive at maximum WTP and minimum WTA through iterations so as to estimate full consumer surplus (Mitchell and Carson 1989). It is presumed that the iterations will allow subjects to search for their true valuations. A bidding game can be used after either closed-ended or payment card questions. As a result, it is susceptible to the same types of bias as closed-ended or payment card questions.

3.3 Design of the study questionnaire

3.3.1 The choice of a good

The good which was chosen to be valued in this questionnaire had to be one which could fill the following requirements: 1) The good would have to be one which had differing levels of substitutability in different people, and 2) this substitutability would have to be represented by a variable which could be readily obtained in a questionnaire. Although the CVM is designed to measure benefits and costs related to nonmarket goods (i.e. many environmental services), issues in the CVM can be investigated using market goods. As such, a market good was chosen according to a research trend within CVM work (Gregory 1986, Knetsch and Sinden 1984). By using market goods, potential problems related to people's ability to place a value on nonmarket goods (i.e. their unfamiliarity with valuing them) can be avoided. The hypothetical issue problem discussed earlier in this chapter can thus be minimized. In this way, the experiment in this study will be able to examine the issue of substitute relationships, with less interference from these hypothetical issues.

The choice of a market good raises questions concerning what the experiment will relate to future valuations of public goods (i.e. for which the CVM was initially developed). It is hoped that an examination of the effect of substitute relationships using a market good, where respondent's have at least some degree of familiarity, might then give an indication of the general range of the substitute effect on WTP-WTA differences. In this way, we may be able to determine how much of the WTP-WTA difference, in a given public good valuation, is due to substitute relationships, and how much is due to the respondent's lack of familiarity in dealing with the certain type of public good.

It is hoped that the experiment using a market good will have a fair amount of application to future valuations of public goods. Public and market goods have certain different characteristics, however, they are similar, for example, in that a compensation price for a certain good (public or market) may have to include some transactions costs. While the existence of transactions costs with market goods may be fairly straightforward, the case of public-type goods may need to be clarified. Consider the potential transactions costs incurred by a hunter who has hunted in the same area for many years. Taking this opportunity away from the hunter will involve transactions costs necessary to account for having to become sufficiently knowledgeable with a new hunting area.

Movie tickets were chosen on the following grounds. Because the choice of university classes for study groups can be an inexpensive way to conduct CVM surveys (consider the saved time and money from avoiding mail-out surveys), a good had to be chosen which students would have some degree of experience with, and which they would be able to afford given their incomes. Movie tickets appear to fill both requirements.

The need to deal with the substitute issue also led to the choice of movie tickets. A good had to be chosen which could potentially have varying substitutability for different people. Watching a movie on a videocassette recorder (VCR) could be a substitute for going to watch a movie at a theatre (though not necessarily a perfect substitute). In addition, the degree that watching a movie on a VCR acts as a substitute could vary according to whether an individual owns a VCR, as well as according to how (s)he may feel about movie theatre experiences. The determination of the degree of substitutability will be discussed below.

The good being valued was further narrowed to being tickets to a movie at a Repertory theatre. Repertory theatres are theatres which primarily show "second-run" movies on one night engagements. This was done for the following reason. Since the research task concerns examining the effect of substitutes on WTP-WTA differences, it became necessary to isolate the possibility for substitutes. In particular, to have a good whose substitutability could vary significantly from person to person. Most movie theatres show movies for relatively extended engagements (often several weeks or more). If tickets to a movie at a conventional movie theatre were chosen as the good, respondents might envision temporal substitution possibilities (i.e. being able to go the next evening). It would seem to be unlikely that this possible temporal substitute would vary much in different people. Instead, the

availability of the same movie on a VCR is structured as the possible substitute. As mentioned earlier and as will be elaborated on later, this possible substitute relationship could vary with different individuals.

Finally, a specific movie feature was chosen so as to heighten the realistic component of the survey. In addition, a feature had to be chosen which appeared to have a wide appeal with the university students being questioned. The "1988 Cannes Commercials" were chosen, as they had been extremely popular locally (see appendix I for the description given to the subjects).

3.3.2 Detailing of the major questions

3.3.2.1 WTP and WTA questions

The WTP question is an open-ended valuation of a one-time chance at a movie ticket, on a feature being shown only once (the date and time being specified in the questionnaire description). The subjects were notified that tickets were only available on one day in advance, during a one hour time period (again with these dates and time specified in the description). Given this scenario, subjects were asked what would be the maximum amount you would be willing to pay for a ticket to the described showing of the feature chosen (again see appendix I for the complete question).

Similarly, the WTA question is a valuation of what would be needed in compensation for a ticket to the same showing which was already owned. In this case, the ticket had been only available in advance (on a day that had already passed). Thus, you would be giving up your only opportunity of seeing this feature in a movie theatre. The WTA question then asked what would be the minimum amount you be willing to accept in compensation for selling back your ticket.

3.3.2.2 Defining possible substitute relationships

As mentioned previously the substitute chosen for seeing a feature at a movie theatre was seeing the same feature on a VCR (the feature was said to be available on video at most video rental stores). The degree to which this was seen to be a substitute was on the following grounds. Firstly if a subject owned or had regular access to a VCR, they would presumably have the ability to partly substitute for this experience by watching the same feature on their VCR. By contrast, if a subject didn't own or have regular access to a VCR, they wouldn't have this same potential for substitution. Questions 8 and 9 from appendix I attempt to outline this relationship.

Possible substitute relationships were further defined by three attitudinal questions (see questions 3, 4 and 5 in appendix 1). These questions attempted to get a measure of each individual's view on the uniqueness of movie theatre outings relative to watching movies on a VCR. Respondents were asked how they reacted (i.e. strongly agree, agree, neutral, disagree, strongly disagree) to statements regarding reasons for going to movie theatres. The reasons used were: primarily to see the feature currently playing, at least partly because it is a good place to go on dates, and at least partly because watching movies on big movie screens is thought to be superior to watching them on television screens. Suppose, for example, that a respondent were to indicate that they strongly agreed with the statement that watching movies on big theatre screens is much superior to watching them on smaller television screens. From this we might infer that watching the feature on a VCR is less of a substitute than if they felt the screen size was not a very important component of a movie theatre experience. Consider also a response of "strongly agree" to the question of going to a theatre at least partly because it is a good place to spend an evening out. We may infer that the VCR experience is a relatively poor substitute (again relative to feeling this is a less important part of the theatre). Finally, consider a response of "strongly agree" to the question of going to a movie theatre primarily for the feature currently playing. In this case (ignoring the other two attitudinal questions for the moment), the VCR experience might be a somewhat better substitute. The net effect, however, of these three attitudinal questions may be somewhat more difficult to interpret (as will be discussed in later chapters).

3.3.3 Additional questions

The remaining questions deal with traditional socioeconomic variables perhaps affecting individual valuations. Age, sex, university faculty enrolled in (as the questionnaire is being administered to university students), and a measure of income are also included in the questionnaire. The income question elicits the amount of money a respondent has left over per month after all expenditures on necessities (i.e. rent, food, utility bills, tuition, textbooks, transportation, etc.). The question was structured in this manner as some students may be still living with their parents and family, while others may be living on their own. Expenditures on necessities in the two cases could be radically different. Thus, an estimate of income which is eligible for use towards movie and other extraneous expenses is obtained.

3.3.4 The questionnaire and issues of bias

Firstly, as touched on previously, choosing a relatively familiar market good, we have perhaps avoided some of issues related to the hypothetical component of CVM surveys. While it still is not an actual transaction, the attempt was made to make it as realistic as possible (i.e. with specified dates, times, and feature). Secondly, in relation to strategic behaviour, the good and scenario chosen aren't likely to produce strong strategic sentiments (as might be the case with environmentalists and the loss of a unique wilderness area). Thirdly, again because the good chosen is a relatively familiar one to most people, there would not appear to be lack of information. Fourthly, the good chosen is one in which people typically pay entrance fees to get access. The payment vehicle chosen should not present a large problem, as respondents are familiar with the concept of having to pay in currency for movie tickets. Finally, as we are using single, open-ended valuation questions, starting point bias is not a factor.

Thus, with the choice of a relatively familiar market good for this study, the prevalence of some of the potential biases should be limited. Some bias no doubt will remain as in any experimental work.

3.4 Issues in the implementation of the questionnaire

This section deals with the evolution of the CVM questionnaire dealt with in this study. In more direct terms, how the questionnaire was altered after pretest runs. The questionnaire was administered to 2 pretest groups with 14 and 40 students respectively.

For most of the questions, the first version of the questionnaire differs very little, if at all, from the final version. Mostly, any changes made were small changes in presentation.

The main changes were in the WTA question. In the first pretest we had a mean WTP of approximately \$3.2 and a mean WTA of approximately \$4.8, in a sample of 9 (with 5 responses eliminated out of the original 14 for missing values, etc.). In the second pretest we had approximate means of \$5.4 for both WTP and WTA, with a sample of 38 (2 eliminated responses). More importantly however, in the second pretest we had 10 individuals with WTP greater than WTA (a full one-quarter of the sample). As mentioned from the outset, empirical results of WTA substantially greater than WTP are problematic to standard economic theory. Empirical results of WTP greater than WTA are even more difficult to explain.

The preceding result was interpreted as meaning that many of the respondents were not understanding the transaction on the WTA side. It was speculated that many respondents thought that they were buying the ticket in the WTP question, and then selling it in the WTA question for a smaller price because they were unable to attend, perhaps selling the ticket to a friend for less than they purchased the ticket for. In response, the WTA question was altered so that the respondent was told to assume that they fully intended on going and did not have any other commitments. In addition, they were told that prior to going to the feature, an official from the theatre telephoned them and asked to buy back their ticket (as tickets had been oversold). These two statements were thus added on to the WTA question.

The valuations, as a result, have the weakness of being susceptible to potential strategic issues. If a respondent has any ill feelings towards the proprietors of movie theatres, they may answer strategically and state extremely high WTA values. This type of behaviour, however, is not thought to be a large problem in the survey.

Chapter 4 Quantitative Analysis

The questionnaire discussed in chapter 3 was administered to three classes of 29, 22, and 117 students respectively. The combined sample was 168. The class of 29 was a summer session course of Economics 201, the class of 22 a summer session course of Economics 381, while the class of 117 was a fall session course of Physiology 260.

4.1 Descriptive Analysis

Descriptive statistics were calculated for the test variables (see table 4-1). The mean WTP was \$4.76, its standard deviation (SD) was 3.30. The mean WTA was \$9.30, its SD was 8.60. Thus, the mean difference between the two measures (difference) was \$4.55, its SD was 8.29. Of our respondents, 63 had equal WTP and WTA values (i.e. difference equal to 0), and 93 had WTA values greater than corresponding WTP values (difference greater than 0). There were 7 respondents with WTP greater than WTA (difference less than 0). A test of means reported in table 4-2 showed the two measure's means to be significantly different at the 1% level using a two-tailed T-test. A caveat should be added here to note that one of the main strengths of the CVM is the ability to avoid having to make assumptions on respondent's preferences. As such, a test of means is getting away from individual behaviour and dealing with group behaviour (where assumptions on preferences would be required).

The "extra income" variable in table 4-1 was elicited in the questionnaire using discrete income ranges (see appendix I). The numbers in table 4-1 correspond to most respondents having "extra incomes" in the 0-100\$ range (53.6%), with most of the remaining respondents in the 101-200\$ range (25.0%), and in the 201-300\$ range (10.7%). Thus, most of the respondents had incomes after expenditures on necessities which were on the lower end of the constructed scale.

The "Theatre usage" variable details that most respondents see 0-1 (38.7%), 1-2 (34.5%), or 2-4 (22.6%) movies per month (on average). This question contained an error in its design as there was no category for respondents who never go to movies at theatres. Hopefully this error will be minimal, as most students go to movies at theatres, at least once in a while.

The three attitudinal variables attempted to determine the reasons people go to movie theatres. They were structured so that respondents were asked to react to each of three statements. There were five categories of possible reactions: strongly agree, agree, neutral, disagree, strongly disagree (using a

scale with 1 being strongly agree, 5 being strongly disagree). Regarding the first statement - going to a movie primarily for the feature currently playing - that most people agreed (48.2%) or strongly agreed with the statement, though a reasonably large number were neutral (12.5%). Regarding the second statement - going to a movie theatre at least partly because it is a good place to go on dates - respondents were split, with the largest numbers agreeing (36.9%), being neutral (32.7%), or disagreeing (17.9%) with the statement. The third statement - going to a movie theatre at least partly because of liking to watch movies on big screens more than watching them on television - had most respondents strongly agreeing (19.0%), agreeing (45.8%), or being neutral (18.5%) with this statement.

Moving downward in table 4-1, the next two variables refer to the respondent's knowledge of, and usage of Repertory theatres. "Rep. know.", Details that 39.9% of respondents have gone to a movie at a Repertory theatre at least once, and 59.5% having never gone. The "Rep. usage" variable, details that 96.4% of the respondents go between 0-1 times per month. As with the theatre usage variable, "Rep. usage" contains the error of not allowing for answers of 0. In this case, this error is more of a problem, with most respondents being in the 0-1 category.

The variables listed "VCR own" and "VCR usage" in table 4-1 describe whether a respondent owns (or lives with someone who owns) a VCR, and how many movies they watch per month on a VCR. 65.5% of respondents have a VCR in their home, and 34.5% do not have one in their home. 29.2% of respondents watch 0-1 movies per month, 23.8% watch 1-2, 26.2% watch 2-4, 13.7% watch 4-6, and 7.1% watch over 6 movies per month on VCRs. The same error in design is present in this case, but is not as big a problem as with "Rep. usage", as the majority of respondents are in the higher categories.

The remaining variables contained in table 4-1 are socioeconomic variables which were included in the questionnaire. 41.7% of the respondents are between 16 and 20 years of age, and 45.2% are between 21 and 25. 56.0% of respondents were male and 44.0% female. The education variable is measured in years of formal education, and had a mean of 14.68 with a SD of 1.49. "Faculty" refers to the faculty at the University of Alberta in which the respondent's are enrolled. The majority of respondents are in the Physical Education faculty (69.6%), though 11.9% are in Sciences

and 8.3% in Arts. This results in a potentially biased sample resulting from the predominant physical education respondents. It would have been preferable to have a more widespread student sample (to say nothing of being preferable to have a sample which did not only contain students).

Table 4-1: Descriptive Statistics

Number of Valid Observations = 157

<u>Variable</u>	<u>Mean</u>	<u>St.D</u>	<u>Min.</u>	<u>Max.</u>
Difference	4.55	8.29	-3.00	50.00
Extra income	1.91	1.36	1.00	6.00
Theatre usage	1.96	.98	1.00	5.00
Feature	2.08	.96	1.00	5.00
Dates	2.83	1.03	1.00	5.00
Big screen	2.35	1.04	1.00	5.00
Rep. know.	1.61	.49	1.00	2.00
Rep. usage	1.04	.22	1.00	3.00
VCR own.	1.35	.48	1.00	2.00
VCR usage	2.46	1.23	1.00	5.00
Age	1.82	1.00	1.00	6.00
Sex	1.43	.50	1.00	2.00
Education	14.68	1.49	12.00	20.00
Faculty	8.15	2.53	1.00	11.00
WTP	4.76	3.30	.00	25.00
WTA	9.30	8.60	.00	50.00
TR. WTP*	4.72	2.88	.00	15.00
TR. WTA*	8.33	5.77	.00	25.00
TR. Difference*	3.60	5.07	.00	25.00

*denotes values after truncations
on WTA and difference; N=148

Table 4-2: Test of Means

<u>Measure</u>	<u>Mean</u>	<u>Standard Error</u>	<u>T-value</u>
WTP	4.76 (3.30) _a	.66374	6.84*
WTA	9.30 (8.60)		

*significantly different at the 1% level using a 2-tailed T-test

_a standard deviations are listed in parenthesis

N=157

4.2 Regression analysis

Investigation into the difference between the two measures can be conducted on two fronts, by directly examining the observed differences, and by examining the measures separately and comparing these results. Regressions were estimated using both WTP and WTA as dependent variables. Through knowledge of the factors determining these two measures, we hope to get insights into what factors could potentially cause them to have different values. Regressions were also estimated using the difference between WTP and WTA as a dependent variable.

4.2.1 WTP regressions

Regressions using WTP as the dependent variable, were estimated to determine which variables influence a respondent's WTP. Following both intuition and previous research using the CVM in this area (Adamowicz and Phillips 1983, Davis 1963, Gordon and Knetsch 1979, Hammack and Brown 1974), income was chosen as one of the possible candidates. Thus, our "extra income" variable was included as a potential determinant of WTP. Standard economic theory certainly suggests that there is a relationship between one's WTP for a specific good and one's income. Attitudes towards movie theatre experiences were also hypothesized to be a significant determinant of WTP. This too corresponds with previous CVM applications, where variables such as experience in the activity, and length of stay, etc., have been used in applications attempting to value recreational activities (Davis 1966, Hammack and Brown 1974). In relation to the study at hand, the attitudinal variables ("feature", "dates", and "big screen" in table 4-1) represent a respondent's tastes towards movie theatre experiences, while the number of movies seen at theatres per month ("theatre usage" in table 4-1) for example, may represent a measure of relative dedication towards movie theatre experiences (assuming equal incomes). Therefore, a person's WTP can be expressed in the following form:

$$WTP_i = (I_i, C_i)$$

where I represents the i th individual's extra income, and C the i th individual's characteristics towards movie theatre experiences (perhaps denoted by one or more of the attitudinal variables, and/or by movies seen at theatres per month).

In examination of regression results, the income variable was not generally found to be a significant determinant of WTP (see table 4-3). One would certainly expect a significant positive relationship between income and WTP. Although the coefficient was consistently positive, it was significant at the 20% level at the closest (table 4-3). Perhaps the lack of significance of the income variable may be a result of the reasonably low variation in income due to all respondents being full-time students (implying relatively uniform and low "extra incomes"). In the distribution of the "extra incomes", 78.6% of respondents were included in the 0-100\$ and 101-200\$ ranges.

In viewing the results relative to personal characteristics variables, of our three attitudinal variables, only Variable 5, the response on theatre screen size was found to be significant at the 10% level using a semi-log form, but only at the 20% level using a linear form (see table 4-3). Here the coefficient was negative, which implies that a respondent's WTP increased as the relative importance of a big screen to a movie theatre experience increased (the attitudinal scale goes from 1-strongly agree to 5-strongly disagree; see appendix I). This result would seem to confer with intuition. Those respondents who value the big screen size of a theatre higher would be expected to spend more on a movie theatre ticket (with the big screen component being unique to movies at theatres). The other attitudinal variables (i.e. "feature" and "dates"), as well as the other movie and vcr variables, under no instances were found to be significant.

At the 5% significance level, sex was the only variable in the questionnaire which was found to be significant (see table 4-3). It had this level of significance using both linear, and semi-log functional forms. The coefficient in this case was negative (as a dummy variable), thus implying that on average, females had higher WTP for the movie tickets than males.

Table 4-3: Willingness-to-Pay Regressions

Dependent	Income	Sex	Big screen	Const.	R-SQ
WTP	.25681 (.18934)	-1.19562 (.51491)**	-.32858 (.24910)	5.74921 (.79062)*	.04904
lnWTP	.02297 (.04048)	-.28598 (.10963)*	-.09609 (.05323)***	1.79679 (.16702)*	.059057

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

N=157

4.2.2 WTA regressions

Regressions were also estimated using WTA as the dependent variable. WTA regressions were estimated along similar lines as WTP regressions. This follows from previous research involving regressions with both measures (Gordon and Knetsch 1979). While the near equality of the two measures may be in some doubt, that WTA would also be a function of income and measures of personal characteristics towards movie theatre experiences appears to be a reasonable initial hypothesis. Thus, a person's WTA could take a similar form to WTP:

$$WTA_i = (I_i, C_i)$$

where I and C again represent the *i*th individual's extra income, and personal characteristics towards movie theatre experiences.

In regressions estimated with WTA as the dependent variable, the "extra income" variable was not found to be significant (see table 4-4). In terms of personal characteristics, the "big screen" attitudinal variable, for example, was not found to be significant (see table 4-4). None of the other possible substitute indicating variables (such as the VCR variables) were significant.

In contrast with the regressions with WTP as the dependent variable, sex was not found to be significant (see table 4-4). In the WTA set of regressions, only a respondent's WTP was found to be

significant at the 5% level. While this result may not seem very interesting, it was done in order to see if WTA was correlated with any variable in the questionnaire. It appears from this analysis that the factors determining the WTA measure are difficult to uncover.

Table 4-4: Willingness-to-Accept Regressions

<u>Dependent</u>	<u>Income</u>	<u>Sex</u>	<u>Big screen</u>	<u>Const.</u>	<u>R-SQ</u>
WTA	-.15377 (.50814)	1.74477 (1.38702)	.4355 (.66961)	7.61751 (2.12677)*	.01231
lnWTA	-.01192 (.04443)	-.01186 (.12292)	-2.3273E-03 (.05925)	2.02699 (.18679)*	.00057
<u>Dependent</u>	<u>WTP</u>	<u>Const.</u>	<u>R-Sq.</u>		
WTA	.76529 (.19765)*	5.60889 (1.14555)*	.08616		

*significant at the 1% level
 **significant at the 5% level
 ***significant at the 10% level

N=157

4.2.3 Difference regressions

The regressions run with difference as the dependent variable are an attempt to directly examine the WTP-WTA divergence. More specifically, they were estimated to examine the effects of potential substitute variables (i.e. owning or having access to a VCR, as well as attitudes towards movie theatre experiences). In this way, the list of independent variables considered here included all the vcr, theatre, and attitudinal variables (questions 2 through 9 in appendix I). This translates to examining the difference between WTA and WTP in the following form:

$$DIFF_i = (S_i, E_i)$$

with S representing a measure of substitute availability, implied by the possible substitute indicating variables outlined above, and E an income effect which sets the bounds between the two measures accepted by standard theory (see Willig 1976, Randall and Stoll 1980).

In general, these potential substitute variables were not found to be significant in explaining any observed difference between the two welfare measures. Neither the "VCR own." (Having a vcr in your home), nor the "big screen" variables were significant in any regression estimates (see table 4-5).

Further regression runs used many different combinations of independent variables in trying to gain additional insight into the WTA-WTP divergence. It is interesting to note that the measure of income chosen also wasn't found to be a significant determinant of the difference between WTA and WTP. The sex variable was found to be significant at the 10% level using a linear functional form (see table 4-5). The coefficient was positive, implying that the difference between WTA and WTP is higher on average for males than for females. This is an interesting result when considering that in WTP regressions, females had significantly higher WTP. Thus, the WTA of males would had to have been much larger. As seen in the WTA regressions, however, sex was not found to be a significant determinant of WTA (though the coefficient was positive, implying that males had higher WTA values).

Table 4-5: Difference Regressions

<u>Dependent</u>	<u>Income</u>	<u>Sex</u>	<u>Big Screen</u>	<u>Const.</u>	<u>R-Sq.</u>
WTA-WTP	-.30334 (.99398)	4.95206 (2.71315)***	1.19897 (1.30983)	2.04226 (4.16019)	.02480
<u>Dependent</u>	<u>Income</u>	<u>VCR own</u>	<u>Const.</u>	<u>R-Sq.</u>	
WTA-WTP	-.41007 (.49016)	-.96871 (1.39067)	6.63807 (2.28301)*	.00678	

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

N=157

4.2.4 Truncated Difference Regressions

It was hoped that truncation might provide more insight into the WTP-WTA difference. As in most CVM studies, there were a few WTA bids which were extremely high and seemed to reflect a misapplication of the survey technique. In an effort to preclude outliers from the analysis, WTA values larger than two standard deviations from the mean were eliminated (i.e. truncation at WTA

values greater than approximately 26). This resulted in 5 responses being taken out of the original sample. As was eluded to earlier, the treatment of extremely high WTA values is a somewhat problematic component of CVM survey results. These results may be real attitudes (implying including them in statistical work), or they represent "noise" resulting from strategic behaviour, or protests to the property right implied by WTA questions (implying eliminating these responses from analysis). As the good being valued is movie tickets (and not a unique wilderness area, for example), it is unlikely that huge WTA values represent actual attitudes. In addition most of the extremely high WTA responses eliminated from analysis were accompanied by extremely low WTP values (i.e. $WTP = \$5.50$ and $WTA = \$50.00$). These types of responses were thought to be a result of strategic behaviour or some other misapplication of the survey technique.

The sample was also truncated at difference values less than zero. This was done because of the difficulty in accounting for this behaviour. These types of responses appear to defy explanation. As was discussed in chapter 3, while WTA values significantly greater than WTP are anomalous with respect to standard theory, WTP values greater than WTA are even more difficult to explain. In reviewing pretest results (see chapter 3), we found that in the second pretest, approximately 25% of respondents had higher WTP values than WTA. At this time it was speculated that the WTA question was not properly specified. In short, that respondents had lower WTA values because they were unable to attend the feature and were selling the ticket cheaply to a friend. Thus, these types of responses were avoided - which is not to say that they don't represent potentially interesting behaviour worthy of study - so as to focus our attention on the main subject of this query. In addition, it allowed for the use of a semi-log functional in difference regressions.

After proceeding with the above truncation described above, the mean WTP was 4.72, the SD was 2.88. The mean WTA became 8.33, and its standard deviation (SD) was 5.77. Thus the mean difference became 3.60, with a SD 5.07.

Truncated regressions using difference as the dependent variable generally conformed to the results of those using the non-truncated sample. The "extra income", and "VCR own" variables again were not significant (see table 4-6). With the truncated sample, the "big screen" variable was found to be significant at the 5% level using a semi-log form, though it again was not when using a linear form (see table 4-6). The coefficient of the "big screen" variable was positive, implying that the difference

between WTA and WTP increased as the relative importance of big screen size decreased. This runs contrary to expectations relative to the substitute hypothesis, as respondents who felt that big screen size was not that important, would be assumed to have watching the same feature on a VCR as a relatively close substitute (thereby not needing extra compensation due to any inherent uniqueness relative to screen size in watching the feature at a movie theatre).

The sex variable was again significant. Using the truncated sample, the sex variable was significant at the 5% level using a linear form and at the 1% level when using a semi-log form (see table 4-6). The coefficient was again positive, implying that the difference between WTA and WTP is higher on average for males than for females. Thus, in general, there was little difference between truncated and non-truncated difference regressions.

Table 4-6: Truncated Difference Regressions

<u>Dependent</u>	<u>Income</u>	<u>Sex</u>	<u>Big screen</u>	<u>Const.</u>	<u>R-SQ.</u>
WTA-WTP	-.4163 (.48078)	2.99877 (1.31233)**	.75007 (.63356)	1.87742 (2.01226)	.04179
ln(WTA-WTP)	-.02732 (.06466)	.51544 (.18999)*	.23950 (.09313)**	.79292 (.30498)*	.13105
<u>Dependent</u>	<u>Income</u>	<u>VCR own</u>	<u>Const.</u>	<u>R-Sq.</u>	
WTA-WTP	-.39352 (.49429)	-.85438 (1.14926)	6.6110 (2.31284)*	.00590	
ln(WTA-WTP)	.18381 (.31952)	-.21962 (.91744)	-2.78599 (1.49507)***	.00278	

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

N=148

4.3 Summary of results

The paucity of significant relationships between independent variables and each of our chosen dependent variables (WTP, WTA, and difference) is quite evident. In terms of WTP regressions, the fact that "extra income" showed little, if any, significance is a very surprising result. A significant positive relationship between income and WTP is certainly expected in these types of experiments. As mentioned above, this lack of significance may have been a result of most (78.6%) of the respondents

being in the lower two income categories. A sample with a more heterogeneous income distribution may have provided different results. An additional result in WTP regressions, females having significantly higher WTP's than males is also worth noting, though difficult to explain.

Turning to WTA regressions, the prevailing result here is that nothing was found to be significant to any reasonable level. The exception to this in the WTA regressions would be the case of WTP as an independent variable, which was attempted merely to see if WTA could be explained by any of the other variables in the questionnaire. That WTP and WTA are correlated should be inherent to the valuation exercise, and provides little insight into this research query. The WTA measure utilized in this questionnaire is problematic in the sense that it has been difficult to find its determinants.

In the difference regressions, several results are of some interest. Notably, that the proposed substitute variables were not, in general, significant. Especially worth noting, is that the variable which determined whether a respondent had a VCR in their home was not significant. While the "big screen" variable was significant in one instance, its coefficient was positive, which was contrary to the expectations of substitute effects outlined in chapter 3. The lack of significance with respect to the income variable carried over to the difference regressions. The sex variable was significant in most difference regression estimates. This is an interesting result, since the coefficient here is negative, while the coefficient (significant in the semi-log form at the 5% level) for WTP was negative. Thus, females had higher WTPs, but males had higher differences. This implies that males must have had much higher WTAs. This wasn't found to be the case, although the coefficient was positive (males having higher WTAs), it was not significant.

Given the preceding analysis, it will be interesting to examine whether the results of another CVM application will conform. As such, a CVM application on hunting values will now be the subject of attention.

Chapter 5 Further Quantitative Analysis

Attention will now shift to the description and analysis of data contained in another CVM application. This involves a CVM survey of recreational hunters in Alberta. The survey attempted to analyze the economics of big-game hunting, and was the subject of previous research at this university (Adamowicz 1983). This study elicited information on the socioeconomic profiles of hunters, and provided estimates of welfare measures for the value of hunting in Alberta. The rationale for using this data set is to determine if the general results in chapter 4 carry over to another CVM application, especially one which is perhaps more of an actual application (as opposed to a constructed "laboratory" experiment designed for a definite investigative purpose). The CVM hunting values will, consequently, be analyzed to see whether the difference between WTA and WTP is partly a result of substitute relationships. Thus, the analytical process followed in chapters 3 and 4 will be repeated in this chapter. This chapter will first briefly describe the questionnaire used in this CVM hunting survey. The next section will present the results of the statistical analysis, which will again include regressions performed with WTP, WTA, and difference as dependent variables. The final section will summarize these results and comment on whether or not they conform to the results of chapter 4.

5.1 Questionnaire design and implementation

The questionnaire was designed to study the social and economic aspects of big-game hunting in Alberta (see Appendix II for a copy of the questionnaire). The questionnaire was sent to samples of licensed hunters in Alberta. The data involved in this study are from a sample of holders of Big Horn Sheep hunting licenses.

The questionnaire was sent by mail to a sample of 1000 holders of sheep hunting licenses. Of the 1000 sampled, 621 returned usable questionnaires. Initially 243 of these were valid responses.

The first section of the questionnaire collected biographical information on the hunters (i.e. city/town of origin, age, household income, sex, hunting experience, reasons for hunting, etc.). The second section contained information on the hunting trips that were made during the past season. The number of trips, their length, cost, success (in terms of the harvest of an animal), and other components were all collected here. The final section of the questionnaire elicited WTP and WTA values of hunting using the CVM.

The WTP question asked for the value (over and above expenses) of a day of hunting. A range of dollar values were listed in ascending order from \$5 to \$100. The respondent was to circle the worth of a day of hunting to them. If their WTP was above or different from the range, they were to specify the amount.

The WTA question asked how much money a respondent would have to be paid not to hunt in Alberta for one year. A range of dollar values again were listed, this time ranging from \$0 to \$900. Similarly, a respondent was to circle their WTA amount, or specify it if it was higher (or different) than the values listed.

The WTP question asked for a valuation of a day of hunting while the WTA question asked for the amount of compensation required for giving up hunting for a year. In this state, the two measures are not comparable (i.e. one is valuing a day of hunting, the other a season). It was necessary, therefore, to get both measures as valuations for a day of hunting. Whether the WTP measure elicited is an average or a marginal measure, however, is also somewhat ambiguous (see Appendix II). In response to this problem, the compensation measure was altered in the following two ways. First, the compensation value was divided by the total number of hunting days taken by that person in the previous year. In this instance then, we are in fact comparing WTP for a day of hunting, with the average WTA amount required to forego a day of hunting (hereafter denoted by AWTa).

The second way in which the WTA measure was transformed involved computing a marginal value for WTA. This was done by first estimating a regression with total compensation as the dependent variable. This "bid function" (see Sellar et Al. 1985) was estimated using a double-log functional form, with income and the total number of hunting days as independent variables. This regression estimate is shown immediately below:

Table 5-1: Total WTA Bid Function Regression

Dependent	lnIncome	lnDays	Const.	R-Sq.
lnTWT A	.31127 (.18163)***	.53477 (.11923)*	2.31312 (1.87074)	.10864

*significant at the 1% level

***significant at the 10% level

N=123

Thus, we have a regression estimation of the following form:

$$\ln(TWTA) = \alpha + \beta(\ln Days) + \gamma(\ln Inc)$$

where "TWTA" is the WTA for giving up hunting for one year, "Days" is the total number of days spent hunting in the previous year, "Inc" the total household income, and where α , β , and γ are coefficients contained in table 5-1. This estimation is then linearized through exponentiation of both sides of the equation. Thus we have TWTA represented by the following function:

$$TWTA = e^{\alpha} Days^{\beta} \cdot Inc^{\gamma}$$

with "e" representing the base of the natural logarithms. Taking the derivative of "TWTA" with respect to "Days" yields a value for marginal WTA of a day of hunting as derived from TWTA:

$$MWTA_i = e^{\alpha} \beta Days^{\beta-1} \cdot Inc^{\gamma}$$

which is a conditional median value of marginal WTA. The measure was further modified to obtain a minimum variance, unbiased estimate of marginal WTA. This was done following the work of Goldberger (1968) in the estimation of Cobb-Douglas functions:

$$E(U) = M(U) \cdot e^{1/2V}$$

where $M(U)$ is the original, conditional median estimate, and "e" the base of the natural logarithms raised to the power of $1/2$ times the variance (V). Thus, the conditional median, marginal WTA measure was multiplied by a factor of the variance in the regression estimate. This is done to adjust for the positive skewness of the estimation (i.e. with the median lying below the mean). The new marginal measure ($E(U)$), now becomes the marginal value of a day of hunting as computed from total WTA (hereafter designated by MWTa). This measure has a notable weakness. It is a computed marginal measure (which is what is wanted for comparison with the direct marginal WTP), however, it is conditional upon the regression estimate used in its derivation (as well as the functional form used, etc.).

5.2 Defining relative substitute availability

As described earlier in this study, in order to attempt to test whether the relative availability of substitutes affects the difference between WTA and WTP, it is necessary to find variables which may indicate differing availability of substitutes in different subjects. To review, it is hypothesized that hunters with lower relative substitute opportunities will have larger differences (again expressed as $WTA - WTP$). Those respondents with extremely high relative substitute opportunities would have much smaller differences (i.e. Hanemann's (1986) hypothesis -see chapter 2 of this study).

It is thought that the relative substitutability of big-game hunting will be indicated in the following way. Different people may have different levels of dedication towards hunting. Some hunters may see hunting as one of a number of recreational activities. In this way, other forms of recreation (i.e. other "outdoors" activities or perhaps participating in sports) may serve as relatively good substitutes. Alternatively, other hunters may see hunting as a more unique activity. They may feel that other recreational opportunities are relatively poor substitutes for the uniqueness of hunting. Consider that hunting is an activity which, in human history, has often been essential to survival. From this we can see how, to some, the "right" to hunt is considered as a "fundamental liberty". Those hunters who feel that hunting is such a "fundamental liberty" would be thought to have relatively poor substitute opportunities. Conceptually then, the relative substitutability of hunting

may be related to a respondent's dedication, or perhaps more aptly stated, to their relative intensity in the hunting activity. Those variables which may indicate this relative "intensity" will be outlined below.

5.3 Descriptive analysis

Descriptive statistics are presented in table 5-2 for the variables relevant to the current study. The mean WTP for a day of hunting is 72.69, with a standard deviation (SD) of 75.08. The first WTA measure, the average WTA (AWTA), has a mean of 154.13 and a SD of 227.18. The second, the transformed marginal willingness-to-pay (MWTa), has a mean of 93.625 and a SD of 34.469. We also have two difference measures. The first, computed AWTA-WTP (Diff1), has a mean of 81.44, with a SD of 215.12. The second, computed MWTa-WTP (Diff2), has a mean of 20.93 and a SD of 81.21. In this survey, the mean AWTA measure was just over two times the mean WTP measure. This is a similar result to the movie ticket valuations, where mean WTA was just under-two times the mean WTP. The mean MWTa however, is just over 25% larger than the WTP measure. In looking at individuals, it is noted that 63.4% of respondents had AWTA greater than WTP, 6% had AWTA equal to WTP, and 30.6% had WTP greater than AWTA. With the MWTa measure, 73.4% had MWTa greater than WTP and 26.6% had WTP greater than MWTa. The prevalence of these negative difference values, as has been noted earlier (see chapter 4), represents surprising behaviour, completely unexpected by standard theory. A test of means reported in table 5-3 showed the two measure's means to be significantly different at the 1% level using a two-tailed T-test. As noted in chapter 4, while this test result provides interesting information, it is getting away from a strength of the CVM (dealing with individual valuations), and dealing with group means (where assumptions on respondent's preferences would be required).

The mean household income in the survey group is 34552.85, with a SD of 11638.48. The mean age is 33.41 years, with a SD of 10.23. In terms of years of big-game hunting experience, the mean is 15.56 years, with a SD of 9.48.

The variables which will be considered in this analysis are measures which attempt to estimate the relative amount of intensity towards the big-game hunting experience. The variable listed as

"CAPCOST" in table 5-2 represents the amount of hunting related purchases of the capital variety (i.e. hunting equipment which will be used for more than one year etc.) which are purchased per year. The mean expenditures on this capital equipment is 440.97, with a SD of 1492.91.

"VEXP" is the amount of expenditures spent on a trip such as expenditures on lodging, transportation, food, and other variable costs of hunting trips. The mean for these variable costs is 690.54, with a SD of 638.55. This variable cost variable was modified to represent the percentage of income spent on hunting. "PEREXP" is the variable costs divided by income. This variable is attempting to find a measure of intensity through the proportion of household income attributable to hunting. The mean here is 0.022 (just over 2% of income spent on variable costs), with a SD of 0.022.

The remaining potential indicators of intensity are "AVGDIST" and "TOTLIC". "AVGDIST" is the average distance travelled per hunting trip. The mean average distance is 100.90 miles, with a SD of 74.29. "TOTLIC" represents the total number of hunting licenses held by a respondent (i.e. with different ones needed for the different species hunted). The mean number of licenses held is 6.81, with a SD of 1.96.

Subjects were also asked to rank a list of reasons for hunting in order of importance. The reasons are: for meat, for trophy, for outdoor enjoyment, for companionship, for exercise, and any other reason, which was to be specified by the respondent. It was thought that a respondent's primary reasons for going hunting would give further evidence of relative substitutability. For example, reasons such as for exercise and for companionship, are more easily substituted than a reason such as for "trophy". In general, going hunting for outdoor enjoyment was the highest ranked reason. 58.1% of respondents ranked it as the first-ranked reason, while 99.1% had it as one of their first three reasons. Hunting for meat, was ranked first by 30% and 76.3% ranked it among their first three. Going hunting for the "trophy" was the first-ranked reason with 12.9% of respondents, and ranked in the top three by 66.2%. Going hunting for companionship was the first-ranked reason with 2.9% of respondents, and ranked in the top three by 44.2%. Going hunting for the exercise was the first-ranked reason with 2.2% of respondents, and ranked in the top three by 21.5%.

Table 5-2: Descriptive Statistics

Number of valid Observations = 123

<u>Variable</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>
Age	33.407	10.227	15.00	66.00
Income	34552.846	11638.477	2500.00	50000.00
Experience	15.561	9.480	1.00	48.00
Meat	2.740	1.366	1.00	6.00
Trophy	3.081	1.377	1.00	6.00
Outdoor	1.537	0.750	1.00	4.00
Companion	3.675	1.198	1.00	6.00
Exercise	3.902	1.043	1.00	5.00
Capcost	440.970	1492.905	0.00	14050.00
Avgdist	100.897	74.290	0.00	375.00
Vexp	690.537	638.551	0.00	6100.00
Pervexp	0.022	0.022	0.00	0.34
Totlic	6.813	1.960	0.00	11.00
Diff1	81.441	215.121	-333.33	1200.00
Diff2	20.251	77.755	-391.20	229.585
WTP	72.691	75.078	0.00	1250.00
TCOMP	1403.780	1567.980	0.00	8000.00
AWTA	154.132	227.177	0.00	1250.00
MWTA	92.942	32.514	34.10	250.213
Tr. WTP*	60.097	44.016	0.00	225.00
Tr. AWTA*	103.360	107.180	0.00	500.00
Tr. MWTA*	88.969	26.128	25.00	159.98
Tr.Diff1*	43.262	103.875	-200.00	436.190
Tr.Diff2*	26.612	50.678	-141.443	125.341

*denotes values after truncations
on WTP and AWTA; N=113

**denotes values after truncations
on WTP and MWTA; N=115

Table 5-3: Test of Means

<u>Measure</u>	<u>Mean</u>	<u>Standard Error</u>	<u>T-value</u>
MWTA	92.942 (32.514) ^a	5.03	*4.026
WTP	72.691 (75.078)	13.90	*5.859
AWTA	154.132 (227.137)		

*significantly different at the 1% level using a 2-tailed T-test
^a standard deviations are listed in parenthesis

N=123

5.4 Regression analysis

Regressions were estimated using similar reasoning to that used in the movie ticket valuations. Investigation into the difference between WTA and WTP, could be initiated both directly (i.e. regressions with difference as the dependent variable), and indirectly by comparing regression results with WTP as the dependent variable with those with WTA in this role. Examining where WTA and WTP regressions concur, and where they differ, may present some insight into the difference between the two.

5.4.1 WTP regressions

Regressions using WTP for outdoor recreation as the dependent variable have received a fair amount of attention in the literature (i.e. Adamowicz and Phillips 1983, Davis 1963, Gordon and Knetsch 1979, Hammack and Brown 1974). Previous research suggests that WTP will depend on income, hunting experience, and hunting related expenditures. We may also include a variable related to a hunter's tastes towards hunting. Therefore, a person's WTP for a day of hunting can be expressed in the following form:

$$WTP_i = (I_i, E_i, X_i, T_i)$$

where I represents the i th individual's household income, E the i th individual's experience in big-game hunting, X a measure of the i th individual's hunting related expenditures, and T that person's tastes towards hunting.

Expenses could, in our application, be represented by any of our variables related to expenditures. Namely, variable expenditures ("Vexp" in table 5-2), capital expenditures ("Capcost"), or proportion of household income spent on variable hunting related expenditures ("Perexp"). A respondent's tastes towards hunting could be related to other survey variables such as, the average distance travelled per trip ("Avgdist"), the total number of licenses held ("Totlic"), or perhaps by our reasons for hunting variable ("Meat", "Trophy", "Outdoor", "Companion", "Exercise").

WTP regression results are presented in table 5-4. Regressions with WTP as the dependent variable had somewhat mixed results in relation to income. Using a linear functional form, income was not found to be significant at the 10% level. Income was significant, however, using both semi-log

(log-linear-5%) and double-log (10%) functional forms (see table 5-4). In all cases the coefficient was positive, which is to be expected. That income generally was found to be a significant determinant of WTP differs with the findings of the movie ticket valuations, where income was not a significant determinant of WTP. The significance of income is a somewhat encouraging result, given expectations of a significant positive relationship with respect to the WTP measure. This result could be a function of the hunting survey containing a more heterogeneous income distribution than did the movie ticket survey.

The big-game experience variable was not significant in any regression estimations. In addition, age, which may convey similar information (i.e. with older hunters generally having more hunting experience), also was not significant.

The variables dealing with hunting related expenditures were not, in general, found to be significant. The one exception being variable expenditures spent during hunting trips, which was significant at the 5% level using a double-log functional form (see table 5-4). The coefficient in this case is positive. A positive relationship implies that those hunters who spend more on variable hunting related expenditures have higher WTP's for a day of hunting.

Of the other variables attempted in WTP regression estimates, the only other significant relationship involved the variable indicating the average distance travelled per trip. "Avgdist" is significant using linear and semi-log (log-linear) forms at the 1% level, and a double-log form at the 10% level. The coefficient in all cases is positive, implying that as the average distance travelled per trip increases, WTP increases.

Table 5-4: Willingness-to-Pay Regressions

Dependent	Income	Avgdist	Const.	R-Sq
WTP	6.065E-04 (4.072E-04)	.19802 (.0691)*	27.0112 (15.6353)***	.0572
lnWTP	1.3112E-05 (5.2741E-06)**	.00258 (8.9504E-04)*	3.1867 (.18986)*	.08253

Dependent	lnIncome	lnAvgdist	lnVexp	Const.	R-Sq
lnWTP	.2500 (.14173)***	.12705 (.07108)***	.17647 (.07321)**	-.32607 (1.3991)	.1078

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level N=123

5.4.2 WTA regressions

As in the analysis of the movie ticket valuations, WTA regressions were estimated along similar lines as WTP regressions. A respondent's WTA was specified as a function of household income, hunting experience, some measure of hunting related expenditures, and the respondent's tastes towards hunting. Thus, a person's WTA for a day of hunting can take the following form:

$$WTA_i = (I_i, E_i, X_i, T_i)$$

where I represents the ith individual's household income, E the ith individual's big-game hunting experience, X the ith individual's hunting related expenditures, and T that individual's tastes towards hunting.

AWTA regressions

The first regression estimates involving WTA will involve the average WTA per day measure (AWTA). In the estimated AWTA regressions, income was not significant (see table 5-5A). This

concur with the results of the movie ticket valuations, where income was not found to be significant. The fact that income is not a significant determinant of AWTA in either of the survey results, is perhaps an indication that while WTP is constrained by income, AWTA is not.

The big-game hunting experience variable was not found to be significant. Unlike in WTP regressions however, age was significant at the 5% level in both linear and semi-log (log-linear) regressions (see table 5-5A). The coefficient in this case is negative which translates to older hunters having lower AWTA values. As mentioned above, it is thought that age may convey similar information as big-game hunting experience. It is worth noting that although the big-game experience variable was only significant at the 15% level at best, it also had a negative coefficient. The negative relationship between AWTA and age (and weak negative relationship between big-game hunting experience and AWTA) could perhaps be a result of older hunters having gone hunting for many years, thus having to be compensated less for not being able to go this year, possibly because they have had many chances at hunting previously. However, this must be said with some degree of caution (older hunters may also have grown more accustomed to the yearly hunt and hence might feel a loss of tradition in not going this year).

Turning now to hunting related expenditures, none of these variables were significant (i.e. capital cost, variable, expenditures, or percent of household income spent on variable expenditures). Of the remaining variables attempted, only the average distance travelled per hunting trip was found to be significant (and only in some instances). Average distance travelled was significant using a linear form at the 5% level, but not when using any logarithmic forms (see table 5-5A). The coefficient was found to be positive, implying that AWTA increased as the average distance travelled per trips increased. This is a similar relationship to that found in WTP regressions (i.e. significant, positive relationship).

Turning to the reason for hunting variables, hunting for meat ("Meat" in table 5-2) is significant at the 5% level in a linear form, and at the 1% level using a semi-log (log-linear) form. This implies that as hunting for meat becomes a less important reason for hunting, AWTA increases.

Table 5-5A: Willingness-To-Accept (AWTA) Regressions

Dependent	Avgdist	Age	Meat	Const.	R-Sq.
AWTA	.47212 (.23045)**	-3.2544 (1.63134)**	29.3849 (11.8005)**	131.5998 (59.3804)**	.0661
lnAWTA	.00141 (.00133)	-.022398 (.00925)**	.21546 (.06478)*	4.4995 (.32663)*	.08960

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

N=123

MWTA regressions

Regressions estimated using the transformed marginal compensation measure (MWTA) in some ways, conformed to the results of the average compensation measure, but on other occasions were inconsistent with AWTA results. Variables which were significant in AWTA regression estimates were also significant in the MWTA regression estimates. Age is significant using both linear and semi-log forms at the 5% level (see table 5-5B). Hunting for meat ("Meat" in table 5-5B) is, in this case, significant at the 1% level in both linear and semi-log forms.

While the average distance travelled per trip ("Avgdist") is significant (5% for both linear and semi-log), the sign of the coefficient is negative with MWTA, while it was positive in AWTA regressions (see table 5-5B). This certainly puts some doubt upon the relationship between "Avgdist" and WTA. Underlying this result, is the question of which of these two measures is a better estimate of WTA for a day of hunting. Answering this question is extremely difficult.

Further MWTA regression estimates showed additional significant relationships. Income was significant at the 1% level (see table 5-5B). The coefficient is positive as expected. This result should not be too surprising. MWTA is constructed using income as one of the independent variables. A regression with MWTA expressed as a function of income, may as a result, violate some statistical properties.

Big-game hunting experience was also significant (see table 5-5B). It had a positive coefficient, and was significant at the 5% level. Interestingly, this coefficient is the opposite sign of that estimated in AWTA regressions. This is further evidence of inconsistencies between the two WTA measures.

Table 5-5B: Willingness-to-Accept (MWTa) Regressions

Dependent	Avgdist	Age	Meat	Const.	R-Sq.
MWTA	-.07872 (.03337)**	-.54477 (.23551)**	8.28897 (1.7209)*	97.5000 (8.6335)*	.15173
lnMWTA	-7.5573E-04 (3.321E-04)**	-.00475 (.00234)**	.07981 (.01712)*	4.5061 (.08591)*	.13954

Dependent	Income	Experience	Const.	R-Sq.
MWTA	6.50661E-04 (1.7854E-04)*	.44542 (.21539)**	76.61970 (7.47243)*	.07534

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level N = 123

5.4.3 Difference regressions

Estimated regressions using difference as the dependent variable were conducted as in the chapter 4 analysis. They were an attempt to directly determine whether the availability of substitutes affects the difference. As outlined previously in this chapter, the substitute relationships were hypothesized to be related to variables determining a respondent's relative intensity towards a hunting experience. More specifically, if a person had a higher level of relative intensity, they would be less able to substitute alternate recreational activities for hunting. Alternatively, if they went hunting each year, but it was not as important an activity, they would be able to substitute with other recreational activities. Several variables were thought to be able to determine such relative degrees of intensity.

The total number of licenses held may relate such information. Those respondents with greater numbers of hunting licenses may be more dedicated to hunting than those with fewer. A hunter who has many licenses, who goes for several species at different times of the year, is probably more dedicated to hunting than one who goes deer hunting one weekend a year. As such, the hunters with many licenses may be less able to substitute alternate recreational opportunities for hunting.

Variables expressing the hunting related expenditures made by respondent's may also detail their relative hunting intensity, and therefore their relative availability of substitutes. Here, we have three possibilities. First, the amount spent on capital equipment. Those who spend more money on capital equipment, again may be seen as more dedicated (assuming equal incomes). Second, the amount of money spent on variable expenses could similarly relate such a measure of dedication or intensity towards hunting (again assuming equal incomes). Third, the percentage of household income which is spent on these variable expenses could also relate a respondent's relative intensity.

An additional variable which may determine the relative intensity would involve the average distance travelled per hunting trip. It is thought that hunters who travel further distances may be seeking more unique hunting opportunities. A more unique hunting activity may signal dedication towards the experience, hence fewer opportunities for substitution.

We also must again consider an income effect, which as expanded upon previously, sets the theoretical bounds of difference (see chapter 2 of this study). Thus, a person's difference can be expressed in the following form:

$$DIFF_i = (S_i, I_i)$$

where S represents the *i*th individual's measure of substitute availability, implied by the variables listed above, and I again represents that individual's income, which would embody any income effect.

Diff1 (AWTA-WTP) results

We now turn to the results of the first set of difference regressions (Diff1), expressed in this instance as the difference between average WTA (AWTA) and WTP. In the analysis of the hunting survey we did find some instances of significant relationships between the dependent variable (difference) and the potential substitute indicating variables. The variable relating the total number

of licenses held was significant using both the linear (10%) and semi-log (5%) forms (see table 5-6A). The coefficient is positive in all cases, which concurs with the intuition explained earlier in this chapter. That is, a respondent with a higher number of licenses will have a higher relative intensity towards hunting, and correspondingly, will have relatively fewer substitute opportunities. Therefore, they were believed to have a larger difference.

Of the variables expressing hunting intensity through hunting related expenditures, only the amount of variable expenditures was significant. It is significant at the 10% level using both linear and semi-log forms (see table 5-6A). The coefficient here is negative, which is somewhat surprising. The initial hypothesis was that those who spent larger amounts on variable expenses would have a higher relative intensity towards hunting, hence fewer substitute opportunities (i.e. higher difference).

Of the ranked reasons for hunting, only hunting for meat was found to be significant (see table 5-6A). It is significant at the 1% level using both linear and semi-log (linear-log) forms. The coefficient is positive, which implies that difference increases as hunting for meat becomes a less important reason for hunting (as the ranking scale goes from 1-highest to 6-lowest). A possible explanation for this relationship might be that people who hunt primarily for meat will have the ability to partially substitute for say, moose meat, with other purchased meats. On the other hand, those who hunt primarily for a reason such as for "trophy", will have relatively fewer substitute opportunities (though the other reasons for hunting were not found to be significant).

The average distance travelled per hunting trip was not found to be significant. Income was not significant in any of the regression estimates. This conforms with the results of the movie ticket valuations.

Table 5-6A: Difference (AWTA-WTP) Regressions

Dependent	Totlic	Vexp	Meat	Const.	R-Sq.
Diff	15.8486 (8.4457)***	-.03988 (.02286)***	30.7038 (11.6953)*	-74.1194 (64.5493)	.05571

Dependent	lnTotlic	lnVexp	Meat	Const.	R-Sq.
Diff	97.71748 (48.0680)**	-30.46624 (17.9921)***	31.82918 (11.7961)*	8.85777 (110.8874)	.05578

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level N=123

Diff2 (MWTa-WTP) results

The second set of difference regressions (Diff2) were expressed as the difference of our transformed marginal WTA value (MWTa) and WTP. The Diff2 regressions, are examined in light of the results of the Diff1 regressions. If the Diff2 regressions conformed with those of Diff1, it would provide more evidence towards any conclusions that may be drawn from the hunting survey data. Nonconformity would impose some doubt on the results of either Diff1 or Diff2 regressions.

Our Diff2 regressions, generally, had fewer significant relationships. Of those variables which were significant in Diff1 regressions, the amount of hunting related variable expenditures ("Vexp" in table 5-6B) is significant only using a semi-log (linear-log) form at the 1% level, though it is not significant using a linear form (see table 5-6B). Similarly, hunting for meat ("Meat") is significant in only one instance using a linear form (10% level - see table 5-6B). The total amount of hunting licenses held, which is significant in the Diff1 regressions reported above, is not significant in Diff2 regressions. Thus, our weak potential evidence of substitute relationships (i.e. the significance of "Totlic" and "Meat") affecting Diff1 values is put into doubt in Diff2 regression estimates.

The only other significant relationship found in the Diff2 regression estimates, involves the average distance travelled per trip. "Avgdist" is significant at the 1% level using a linear form (see table 5-6B). The coefficient in this case is negative, implying that as "Avgdist" increases, Diff2

decreases. It is difficult, however, to make any inferences from this relationship. Recall that the sign of the "Avgdist" variable changed depending upon the WTA measure used (i.e. positive for AWTA, negative for MWTA).

The results of the Diff2 regression estimates put into doubt any weak evidence that may have obtained in Diff1 regressions of the substitute availability affecting difference values. As such, the results of the difference regressions involving the hunting survey generally concur with those of the movie ticket survey.

Table 5-6B: Difference (MWTA-WTP) Regressions

<u>Dependent</u>	<u>Totlic</u>	<u>Vexp</u>	<u>Meat</u>	<u>Const.</u>	<u>R-Sq.</u>
Diff2	-.40657 (3.1154)	-.01221 (.00847)	4.8512 (4.2827)	23.9946 (24.0453)	.02148
<u>Dependent</u>	<u>lnTotlic</u>	<u>lnVexp</u>	<u>Meat</u>	<u>Const.</u>	<u>R-Sq.</u>
Diff2	14.9187 (17.7987)	-18.8116 (6.5427)*	5.5034 (4.2575)	99.2408 (40.3643)**	.05380
<u>Dependent</u>	<u>Avgdist</u>	<u>Meat</u>	<u>Const.</u>	<u>R-Sq.</u>	
Diff2	-.31746 (.082167)*	8.10002 (4.3970)***	34.04134 (14.3041)**	.09293	

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

N = 123

5.5 Further regression analysis

In attempting to get additional information regarding the WTA-WTP difference, a few other regressions were estimated. First, the results were truncated in an attempt to eliminate any outliers. As in chapter 4, WTP and WTA values more than 2 standard deviations from the mean were eliminated from the sample. By removing outliers, it was hoped that the regression estimates would give further inferences towards the likeliness of substitute availability affecting difference.

Because of the high number of negative difference values in the hunting sample, further regressions were estimated first using positive difference values, and then using negative difference values as the dependent variable. This was done in an attempt to distinguish the two groups of respondents and consider the difficulty in accounting for the negative difference values (as discussed previously in this study).

5.5.1 Truncated difference regressions

Truncations were made at values of WTP and WTA more than 2 standard deviations from the mean. After truncation, the mean WTP is 60.10, its standard deviation (SD) is 44.02 (truncated descriptive statistics are reported in table 5-2). The mean AWTa is 103.06, its SD is 107.18. The mean MWTA is 88.969, its SD is 26.128. Truncated Diff1 has a mean of 43.26, with a SD of 103.88. Truncated Diff2 has a mean of 26.61, with a SD of 50.68.

In general, the results of truncated difference regressions showed less significance (see table 5-7). This is a surprising result. Normally, we would expect that the removal of outliers would improve the fit of the equations and variables (with non-systematic behaviour removed). In addition, the truncated results put doubt on the previous difference regressions. The significant, positive relationship between the total number of licenses held and Diff1 is contradicted by the not significant, and negative relationship in truncated Diff1 regressions (see table 5-7).

Table 5-7: Truncated Difference Regressions

Dependent	Totlic	Vexp	Meat	Const.	R-Sq.
Tr.Diff1 _a	-10.81713 (4.460757)*	-.00638 (.01163)	6.02522 (6.02969)	-39.1870 (34.02234)	.03834
Tr.Diff2 _b	-3.13833 (2.26864)	-.01528 (.00606)**	2.74423 (3.05432)	58.84121 (17.46733)*	.07489

*significant at the 1% level

**significant at the 5% level

***significant at the 10% level

a N=113

b N=115

5.5.2 Positive and negative difference regressions

Regressions using only positive difference values, or alternatively, only negative difference values were again estimated with the results of the initial non-truncated regressions in mind.

In this set of regressions, the positive difference regressions generally contained more significant relationships. In the positive Diff1 regression reported in table 5-8, hunting-related expenditures ("Vexp") and hunting for meat ("Meat") are significant at the 5% level. Negative Diff1 regressions have the total number of hunting licenses held ("Totlic") and "Meat" significant at the 10% level. More importantly perhaps, the equation of the positive Diff1 regressions were highly significant, while those for negative Diff1 values were not (see table 5-8).

Positive Diff2 regression estimates had "Totlic" significant at the 1% level and "Vexp" significant at the 10% level. Negative Diff2 regressions had "Totlic" significant at the 5% level. In this case both equations were significant, though the positive regression estimate had a slightly better fit.

This set of regressions may provide some evidence of the negative values representing less systematic behaviour. Perhaps this type of behaviour results from a lack of understanding regarding the CVM questioning.

Table 5-8: Positive/Negative Difference Regressions

<u>Dependent</u>	<u>Totlic</u>	<u>Vexp</u>	<u>Meat</u>	<u>Const.</u>	<u>R-Sq.</u>
+Diff1	17.74813 (12.60863)	-.06529 (.02938)**	40.63491 (16.20149)**	-19.66387 (92.45761)	.08546
significant F=.0189 N=85					
-Diff1	6.51768 (3.52319)***	.002687 (.013523)	9.40491 (5.61981)***	-116.0016 (29.94496)*	.09210
significant F=.1471 N=38					
+Diff2	-4.87615 (1.75244)*	-.00835 (.00483)***	3.30104 (2.35931)	6.30588 (13.55510)*	.14329
significant F=.0002 N=90					
-Diff2	13.88714 (6.15465)**	.02052 (.016613)	1.42793 (8.88065)	-181.98526 (47.75579)*	.16465
significant F=.0459			N=33		
*significant at the 1% level					
**significant at the 5% level					
***significant at the 10% level					

5.6 Summary of results

In looking back at the regressions of this chapter, most of the results conform with those of the movie-ticket valuations. In reference to difference regressions, there is little, if any, evidence supporting the hypothesis of substitute relationships affecting difference values. While the total number of licenses held ("Totlic") was significant with the expected sign in Diff1 regressions, this result was contradicted in Diff2 regressions, where it was not found to be significant. The variables which were thought to indicate the relative substitute opportunities were not generally found to be significant.

Turning to WTP regressions, the fact that income was significant in the hunting survey (it was not significant in the movie ticket valuations) is worth noting. As mentioned previously, it is thought that this may be a result of the hunting survey having a more heterogeneous income distribution than was present in the movie ticket survey.

WTA regression estimates were generally more successful (i.e. in terms of significant relationships) with the hunting survey than with the movie ticket valuations. Recall that in the movie ticket valuations, WTP was the only variable which was found to be significant. It must be added however, that the hunting survey did not have completely comparable measures. Therefore, the power of comparison between WTA measures in the two surveys is somewhat limited.

Chapter 6 Summary and Conclusions

The purpose of this study was to investigate an apparent impasse between empirical results and standard economic theory. More specifically, the study was to investigate the large differences found in contingent valuation method (CVM) surveys, between willingness-to-pay (WTP) and willingness-to-accept (WTA) measures of welfare change. These empirical results, were in contrast to theoretical expectations of near equivalence. This concluding chapter will summarize the course of this study, and will attempt to outline what inferences can be drawn from these proceedings. Finally, subjects for further research will be mentioned.

This study began with a description of the primary question which was to be addressed. Chapter 2 introduced the necessary theoretical background for the formulation of a research plan. The existence of large differences between WTP and WTA welfare measures, when elicited through CVM surveys, were contrasted with theoretical expectations. In light of the impasse, possible explanations were then proposed. The research agenda was then modified to concentrate investigation on the effects of substitute relationships on difference values. Following Hanemann's (1986) hypothesis, low levels of substitutability were expected to correspond with high difference values, while higher levels of substitutability were to correspond with low difference values.

The study then turned to the development and implementation of a survey designed to test Hanemann's hypothesis. Chapter 3 first outlined some of the primary issues in the design of a CVM survey. Following this, a description of a survey involving valuations of movie tickets was presented. It was thought that movie tickets may be an example of a good which might have different levels of substitutability for different people. Those respondents who had a video-cassette recorder (VCR) in their home (the feature being valued was also said to be available on VCR), would have a higher level of substitutability than those who did not. Additional variables indicating reasons for going to movie theatres were also thought to indicate relative substitutability. For example, those respondents who strongly agreed with the statement that "they found large movie theatre screens much better to watch a movie on than smaller television screens", were assumed to have lower relative substitutability than those who did not feel big theatre screens were as important.

Chapter 4 presented the results of quantitative analysis performed on this movie ticket data. Namely, the results of regressions using difference, WTP, and WTA, each as the dependent variable.

Chapter 5 is a digression using a different set of data to further examine the primary study question. It was thought that the results of an actual CVM survey would possibly add conviction to whatever inferences drawn from the previous survey data. This data originated from a CVM survey on recreational hunting in Alberta. In this case, the relative substitutability was assumed to be related to a respondent's dedication towards hunting. Those respondent's with higher levels of dedication towards hunting would be less able to substitute other recreational opportunities for hunting. Analysis in this chapter corresponds to that performed on the earlier data set. Again, regression estimates using difference, WTP, and WTA, each as the dependent variable, were used to investigate this issue.

What conclusions can be drawn from the above procedure? In consideration of our primary research question - whether the availability of substitutes affects the difference between WTP and WTA measures of welfare change - the following can be said. The two CVM surveys showed no substantial evidence which supported the substitute hypothesis. In general, the possible substitute indicating variables were not found to be significant determinants of difference. With reference to the movie ticket valuations, our primary substitute indicating variable, whether or not a respondent had a VCR in their home, was not significant in difference regression estimates. Attitudinal questions on why respondents went to movie theatres (i.e. at least partly for the value of a big theatre screen in the experience) also were not generally significant in difference regressions.

In terms of the hunting survey, variables which were to indicate a respondent's dedication or intensity towards hunting were not significant in a consistent manner. Though there were some instances of significant relationships, there was inconsistency between the regression results of our two different difference measures in the hunting survey.

At this point, it is necessary to add some cautions in regards to the preceding general conclusion. Though we found no substantial evidence of the availability of substitutes affecting difference magnitudes, any conclusions are far from being equivocal. Firstly, the task of deciding which variables might indicate relative substitutability is not an easy one. In the movie ticket valuations, choosing a substitute variable (VCR ownership) seemed fairly straightforward, as the survey was constructed with this purpose in mind. It is difficult, however, to tell how good a substitute watching a feature on a VCR is for watching the same feature at a theatre. Perhaps if the survey were

to be repeated, a question directly asking about this relative substitutability would be asked. This problem is magnified in the hunting survey. In this case, the survey was not constructed to test this hypothesis. As a result, the relative substitutability was determined subjectively. It is difficult to tell whether measures which were to estimate dedication or intensity towards hunting actually are effective substitute indicator variables.

A second caution involves the CVM in a general sense. The accuracy of CVM welfare estimates is still not beyond doubt. There is likely to be a fair degree of measurement error in any CVM application (see Cummings et Al. 1986).

It is still difficult to know how much statistical, strategic, hypothetical, or other "noise" is involved in the welfare measures generated from CVM surveys.

Along similar lines, the results of the hunting survey difference regressions should be dealt with cautiously. The WTP and WTA measures are not truly comparable. Both of the computed per day WTA measures have certain weaknesses. Hence, the resulting difference measures potentially contain some additional measurement error.

Regression estimates using WTP and WTA each as the dependent variable also provide some insight into the occurrence of large difference values. In terms of the movie ticket survey, WTP regression estimates are generally better explained (in terms of significant relationships) than WTA regressions. WTP regressions contained some significant relationships. While income was not a significant determinant of WTP, it was, in some cases, quite close. Furthermore, it has been noted that the income distribution in the movie ticket survey is quite limited to uniformly low incomes. Thus, such a limited variation in incomes may not be expected to result in significant relationships with either WTP or WTA. On the other hand, WTA regressions in the movie ticket survey had only one significant relationship, that being WTP. With the movie ticket survey therefore, we may have some evidence suggesting that the WTA contains more "noise" than the WTP measure.

In regressions using the hunting survey, there were generally more significant relationships with both WTP and WTA measures. Both computed WTA measures had certain significant relationships. As such, in the hunting data analysis, we can not really say that one measure was better explained (again in terms of significant relationships).

Turning now to further research, several paths are suggested from this study. First, in relation to the movie ticket valuations, the fact that sex is significant is an interesting result. Unfortunately, the paucity of female hunters in our survey, made further investigation into this result impossible. If, in fact, males have significantly higher difference values in other CVM surveys, it would have implications on further welfare estimation. Namely, if difference values (hence WTP and WTA measures) between the sexes differ, any CVM survey should attempt to ensure a representative distribution of males and females. Investigation into the possible prevalence of this result is certainly required.

A second path for future research would involve the occurrence of substantial numbers of negative difference values (i.e. $WTP > WTA$). That a respondent's selling price is less than their buying price is an unexpected result. In the movie ticket survey, only 4.29% of respondents had negative difference values. In the hunting survey however, 30.6% had negative difference values when using the average WTA (i.e. $WTP > AWT$). When using the computed marginal measure, 26.6% had negative difference values (i.e. $WTP > MWT$). The high number in the hunting survey could perhaps be a result of the WTP and WTA measures not being completely comparable. Though some limited regression analysis attempted to address this issue, the investigation was of a very preliminary nature.

Further research should also be directed towards individual WTP/WTA differences. Most CVM applications have compared mean WTP and WTA values between different groups of people (i.e. Bishop and Heberlein 1979, Knetsch and Sinden 1984). As one of the main strengths of the CVM involves its ability to deal with individual behaviour (thereby avoiding some relatively limiting assumptions on preferences present in, for example, the travel cost method), attention should be focused to comparing individual WTP and WTA values.

Research must also address the CVM in a more general sense. In particular, addressing the design and implementation of better CVM surveys in regards to the specification and description of valuation applications. How well respondents understand the good being valued, and the scenario in which it is presented are questions which need further attention.

Additional issues which require investigation involve the role of property rights. The two welfare measures are unique in the implications they have towards the allocation of property rights. If we consider a CVM survey designed to elicit the change in consumer welfare as a result of a new

factory which will reduce air quality by a certain amount, using WTP to avoid having the factory built "implicitly assigns industry the property right to the resource" (Carson and Navarro 1988, p.820). Conversely, using WTA "implicitly assigns a quasi-property right to the broader public" (Carson and Navarro 1988, p.820). WTP and WTA are assumed by standard theory to be approximately equal in most applications. Given that, as outlined above, they are unique in regards to the designation of property rights, investigation must determine whether any discrepancies may be a result of problems within the property rights specification.

It has been said that "Economics as currently learned and taught in graduate school and practiced afterward is more theory-intensive and less observation-intensive than perhaps any other science" (Smith 1989, p.151). More observation is needed then, to provide insight into the relationship between WTP and WTA.

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Appendix I: Movie Ticket Questionnaire

Consumer Preference Survey

1. How much money do you have left over per month to spend after all expenditures on necessities (ie rent, food, utility bills, transportation, tuition, textbooks, etc)?

\$0-100 ____ \$101-200 ____ \$201-300 ____ \$301-400 ____ \$401-500 ____ \$501+ ____

2. How many movies do you go to each month (on average)?

0-1 ____ 1-2 ____ 2-4 ____ 4-6 ____ 6+ ____

For questions 3-5, how do you react to the following statements? Check one of the following categories for each question.

(SA-strongly agree, A-agree, N-neutral, D-disagree, SD-strongly disagree)

3. "I go to a movie theatre primarily to see the feature that is currently playing and not just as a place to spend an evening out."

SA ____ A ____ N ____ D ____ SD ____

4. "I go to a movie theatre at least partly because it is a good place to go on dates."

SA ____ A ____ N ____ D ____ SD ____

5. "I go to movie theatre at least partly because I like to watch movies on big screens much more than on television."

SA ____ A ____ N ____ D ____ SD ____

6. Do you ever go to see movies at Repertory theatres like the Princess theatre? (ie showing primarily "second-run" movies)

Yes ___ No ___

7. How many times each month (on average) do you go to see movies at Repertory theatres?

0-1 ___ 1-2 ___ 2-4 ___ 4-6 ___ 6+ ___

8. Do you own (or does someone you live with own) a VCR?

Yes ___ No ___

9. How many movies each month (on average) do you watch on a VCR?

0-1 ___ 1-2 ___ 2-4 ___ 4-6 ___ 6+ ___

10. Age (please check one category)

16-20 ___ 21-25 ___ 26-30 ___ 31-35 ___ 36-40 ___ 41+ ___

11. Sex

M ___ F ___

12. Education (please mark the number of years you have completed)

Elementary/J.High/H.School: 1 2 3 4 5 6 7 8 9 10 11 12

University: 1 2 3 4 5 6 7 8 9

College: 1 2 3 4 5

Other: _____ 1 2 3 4 5

13. Faculty

Agricul/For _____ Arts _____ Business _____ Education _____

Engin. _____ Fine Arts _____ Grad Studies _____ Nursing _____

Phys Ed _____ Sciences _____ Other (please specify) _____

Tickets for the September 25, 1989 (8p.m. at a well known Repertory theatre in Edmonton) showing of the "1988 Cannes Commercials" (see bottom of page for a description of this feature) are being sold only in advance on September 18, 1989 between 5p.m. and 6p.m. Tickets will only be available at this time (ie they will not be available at the door or at any other time or place). This will be the last showing of the "1988 Cannes Commercials" at any theatre in Edmonton this year. Initial reaction to this last showing has led us to believe that tickets will be in big demand. The "1988 Cannes Commercials" is also now available for videocassette rental at most video rental stores.

Given the preceding information, what would be the maximum amount you would be willing to pay for a ticket to the September 25 showing of the "1988 Cannes Commercials"? _____

1988 CANNES COMMERCIALS

"Last year's free-wheeling and supremely entertaining batch of international ads - more than 100 of them, including pepperoni-eating piranha, a fabulous black-and-white spot for Yves St. Laurent, gorillas and modern toilet technology, a Van Gogh inspired Knorr sauces ad, spitting images, Joe Isuzu, upper-class nappies, Stevie Ray Vaughan selling New Zealand, Heineken's painting dog, Marilyn Monroe hawking beer, and much more! (1988. Parental Guidance. 97 mins. Some subtitles)"

From: The Princess Magazine. March, April, May 1989.

Now assume that you have a ticket for the September 25, 1989 showing of the "1988 Cannes Commercials". Assume also that you fully intend on going and do not have any other prior commitments. Tickets were only available in advance on September 4, 1989 between 5p.m. and 6p.m. (ie you will not have another chance to obtain a ticket). Recall that the "1988 Cannes Commercials" is also available for videocassette rental.

Before leaving home to go to the "1988 Cannes Commercials", an official of the theatre telephones you and offers to buy back your ticket (as tickets to the presentation had been oversold). Given this preceding information, **what would be the minimum amount of money you would have to receive in exchange for selling your ticket back to the theatre?** _____

Appendix II: Hunting Questionnaire

E

CONFIDENTIAL

ALBERTA BIG GAME HUNTING

RESIDENT SURVEY

1981 HUNTING SEASON

1. Residence (nearest city or town) _____
2. Age _____
3. Please indicate where you spent the majority of your youth:
_____ Rural Area (less than 1,000 population)
_____ Town (1,000 to 10,000 population)
_____ City (over 10,000 population)
4. Sex: Male _____ Female _____
5. Occupation _____
6. Including yourself, how many of your immediate family are living at your residence (please circle).
1 2 3 4 5 6 7 8 9
7. Approximately what was the total amount of money earned by you and your family in 1981?

Less than \$5,000 _____	\$25,001-\$30,000 _____
\$5,001 - \$10,000 _____	\$30,001-\$35,000 _____
\$10,001 - \$15,000 _____	\$35,001-\$40,000 _____
\$15,001 - \$20,000 _____	\$40,001-\$45,000 _____
\$20,001 - \$25,000 _____	\$45,000-OR OVER _____
8. Education (please circle highest year completed)
Grade School 0 1 2 3 4 5 6 7 8 9
High School 10 11 12
University 1 2 3 4 5 6 7 8 9
Technical School 1 2 3 4
9. Please respond to each question below by checking the appropriate answer:
 - a. Have you ever hunted big game before the 1981 season? YES _____ NO _____
 - b. Have you ever hunted big game in Alberta before the 1981 season?
YES _____ NO _____

10 Please indicate the number of years of hunting experience you have had for the following categories:

a Big Game _____

b Bird Game _____

11 What are the main reasons that you go hunting?

Rank (1st, 2nd, etc.) the following items in order of importance.

a For Meat _____

b For a Trophy _____

c For Outdoor Enjoyment _____

d For Companionship _____

e For Exercise _____

f Other (please specify) _____

12 Which Alberta licenses did you hold in 1981?

☐ Bird Game ☐ Trophy Sheep

☐ Migratory Bird Game ☐ Moose

☐ Mule Deer ☐ Elk

☐ Whitetailed Deer ☐ Caribou

☐ Angling License ☐ Black Bear (spring)

☐ Grizzly Bear ☐ Goat

☐ Non-Trophy Sheep ☐ Black Bear (fall)

☐ Other (please specify) _____

13 Did you hunt Big Game for sport at least once during the 1981 hunting season in Alberta

YES ____ If "YES" please complete the questions that follow

NO ____ If "NO" please return this questionnaire in the self addressed envelope that has been provided.

14 If you did hunt big game in 1981, please complete the following information for each hunting trip taken (NOTE 1 full day of hunting is 4 or more hours in the activity)

Trip No. 1

Areas Hunted (town, landmark or WMU) _____

Days Hunted in Area (estimate to nearest one half day) _____

Miles to Area _____ No. in Hunting Party _____

Game Hunted in the Area _____

Game Bagged by Yourself (type and number) _____

Trip No. 2

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area _____

Game Bagged by Yourself _____

Trip No. 3

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area _____

Game Bagged by Yourself _____

Trip No. 4

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area _____

Game Bagged by Yourself _____

Trip No. 5

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area _____

Game Bagged by Yourself _____

Trip No. 6

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area _____

Game Bagged by Yourself _____

Trip No. 7

Areas Hunted _____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in Area _____

Game Bagged in Area _____

15. Based on your experience, how would you rate your hunting trips in Alberta in 1981?
(check one)

☐ VERY GOOD ☐ GOOD ☐ FAIR ☐ POOR ☐ VERY POOR

16. Please estimate as best you can the amount of money you personally spent for big game hunting in Alberta, in 1981. Please estimate for each category as it applies to you

a Travel Costs \$ _____

(includes gasoline, oil, air fare, etc.)

b Lodging \$ _____

(includes hotels, motels, camping fees, etc.)

c Food \$ _____

(includes restaurant meals, food purchased for camping, etc.)

d Beverages \$ _____

e Rentals \$ _____

(includes rental of hunting equipment)

f Guides \$ _____

(includes guiding fees, etc.)

g Ammunition \$ _____

h Hunting Services \$ _____

(includes packer fees, taxidermy, etc.)

i Other \$ _____

(please specify) _____

17. If you made any major purchases for hunting big game in Alberta (in 1981), that are used in whole or in part for hunting in Alberta, please list the item, the purchase price and the extent to which this item is used for big game hunting in Alberta

a ITEM _____ PURCHASE PRICE _____

Percentage of Time Item is Used for Alberta Big Game Hunting (circle one)

2% 5% 10% 25% 50% 75% 100% OTHER ____%

b ITEM _____ PURCHASE PRICE _____

Percentage of Time Item is Used for Alberta Big Game Hunting

2% 5% 10% 25% 50% 75% 100% OTHER ____%

c ITEM _____ PURCHASE PRICE _____

Percentage of Time Item is Used for Alberta Big Game Hunting

2% 5% 10% 25% 50% 75% 100% OTHER ____%

18. If you participated in Big Game hunting activities in Alberta, in 1981, how much value in dollars per day was it worth to you, above what you spent on travel and other expenses. (circle the appropriate value)

Average Dollar Value per Day

\$ 5 10 15 20 25 30 35 40 45 50
\$ 55 60 65 70 75 80 85 90 95 100

Higher or other dollar value (specify) \$ _____

19. Approximately how much money would you have to be paid not to hunt big game in Alberta for one year. (Estimate and circle the least amount acceptable to you)

\$ 0 1 2 3 4 5 6 7 8 9
\$ 10 20 30 40 50 60 70 80 90
\$ 100 200 300 400 500 600 700 800 900

If higher or other dollar value, please specify: \$ _____

20. Have you ever used a guide in your hunting in Alberta?

____ YES ____ NO

--If 'yes', did you use one in the spring of 1981?

____ YES ____ NO

--If 'no', would you consider using a guide?

____ YES ____ NO

If you would not consider using a guide, please comment on why not

If you would consider using a guide, please state how much you would be willing to pay for guiding services per day.

\$ 10 20 30 40 50 60 70 80 90
\$ 100 110 120 130 140 150 160 170 180 190 200

If higher or other, please specify \$ _____

21. Do you feel that wildlife resource use in Alberta is: (check one)

(a) Excessive _____ (b) Adequate _____ (c) Underutilized _____

If you checked (a) or (c), what would you recommend as a solution to these problems?

22. Give any additional comments that might help evaluate big game hunting in Alberta
